AUSTRALIA'S NUMBER ONE ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

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FEBRUARY, 1983

AUST $2.00* NZ $2.50

PHONOGRAPHS ARE ANTIQUES

THE COMPACT DISC IS HERE!

- TRANSISTOR-ASSISTED IGNITION SYSTEM
- SIMPLE MOISTURE ALARM TO BUILD
- THE PERILS OF SPACE DEBRIS
- OTRONA PORTABLE COMPUTER REVIEWED

BONUS 48-PAGE ALTRONICS CATALOG

Power you can taste.

Sony's new TA-AX5 amplifier with memory is a high fidelity feast.

Its multiple memory lets you create your own acoustic "flavours." Bass and treble tone settings, turnover frequencies, high and low filter are all programmable.

At a touch you can instantly recall the recipe for bittersweet country, hot 'n' spicy rock, or a well-seasoned Stravinsky. And electronic displays graphically show you everything the amp is cooking up.

Sony's Audio Signal Processor means that every function is touch controlled. This knifes through the usual maze of audio circuitry for a streamlined design of the future. Pure and simple, it sounds delicious.

TA-AX5

The ideal companion for this tasty new amplifier is Sony's ST-JX4 synthesizer tuner. Why not make a reservation for two?

ST-JX4

SONY®
THE ONE AND ONLY

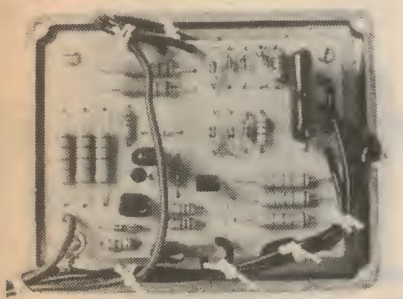
SON 0118

ELECTRONICS AUSTRALIA

Volume 45, No. 2
February, 1983

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

Transistor-assisted ignition



This updated version of our December 1979 Transistor Assisted Ignition System features longer spark duration and an opto-electronic trigger system to replace the points. Details on p44.

Once regarded as an expensive luxury, the Wheatstone bridge can now be built for a quite modest cost, and in much improved form. Full constructional details are on p82.

On the cover

Contrast in disc technology: our cover this month shows Sony's new compact disc player and a vintage 1907 "Dulciphone". See articles beginning pages 28 and 32 for details of the compact disc. (Dulciphone courtesy of the Museum of Applied Arts and Sciences, Sydney.)

FEATURES

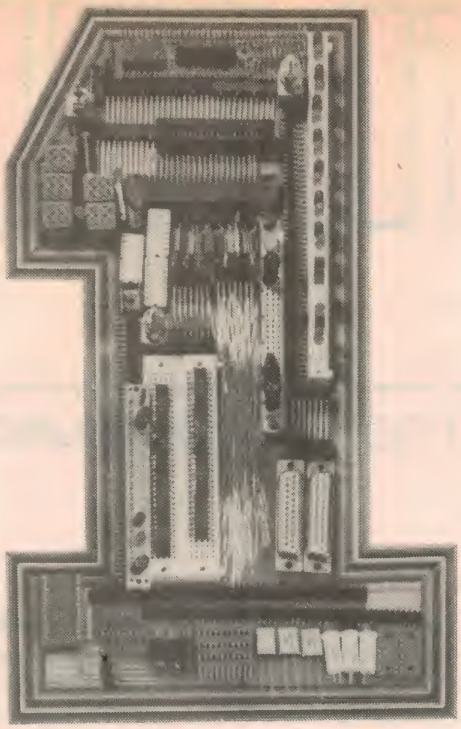
HIFI, VIDEO AND REVIEWS

PROJECTS AND CIRCUITS

PERSONAL COMPUTERS

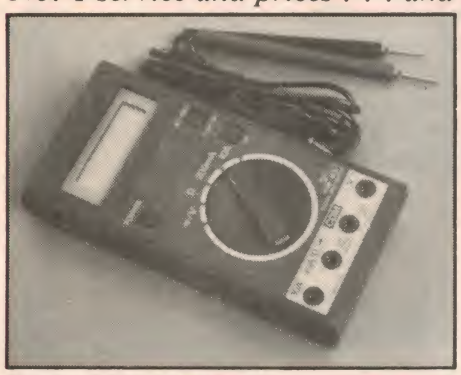
COLUMNS

DEPARTMENTS

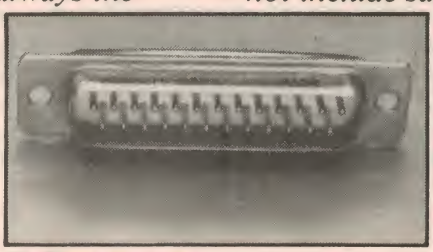


No.1 for any bits.

In the electronic component field today, being No. 1 is tough. At the new Ampec Trade Shop, we already have a No. 1 address . . . and No. 1 service and prices . . . and always the No. 1 products. Quite simply, we want to be No. 1 with you. Here are some of our current specials available while stocks last — prices do not include sales tax.

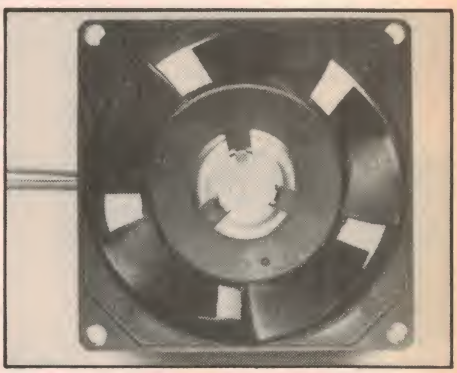


Digital Multimeter
3½ digit LCD multimeter with 10 amp range. ME 531 — *$45.00*



D Connectors

ADIN — 1S — 25P	*$1.91*
ADIN — 1S — 25	*$2.82*
ADIN — 1S — 9S	*$2.49*
ADIN — 1 — 9P	*$1.89*
ADIN — 15S	*$3.51*
ADIN — 15P	*$2.52*

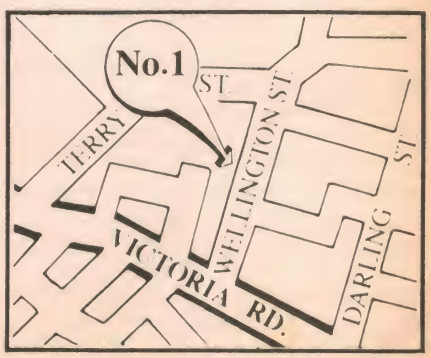


Fans
4″ fan —240V EP114-38 *$11.00*
3″ fan —240V EP 75-38 *$11.00*

These prices while stocks last — sales tax not included.

The Ampec Trade Shop

No. 1 Wellington Street, Rozelle, NSW 2039
Phone: 818 1166



AMPEC
The absolute in peripheral thinking.

Editorial Viewpoint

The Compact Disc is here!

This month we have devoted our cover and a substantial amount of editorial to the Digital Audio Disc or, as it is more likely to become known as, the Compact Disc. Our cover juxtaposes a Sony CD player against an historic phonograph to emphasise the great leap in technology that the Compact Disc represents. In fact, the Compact Disc represents the biggest step forward in sound recording since the days of Edison.

No longer are sound waveforms to be recorded as wiggles in the groove of a vinyl disc or as analog variations in magnetic field on tape. From now on, the standard method of recording will involve digital technology. No doubt many refugees from the microprocessor who previously regarded audio as the last bastion of analog circuitry will be horrified, but it is here to stay and it is potentially far better than the sound technology we have revelled in to date.

It is a safe bet that many of the local companies who will be distributing compact disc players do not realise the potential of the CD system. And it will probably be some time before recording engineers utilise this new medium to the best advantage. But even at this early stage it is obvious that the Compact Disc will ultimately wipe out records and tapes as we know them today.

Just imagine a system with no tape hiss, no hum, no surface noise or in fact, virtually no background noise at all. This same system has no wow and flutter, no rumble, no acoustic feedback, no problems with record warp, no tape print-through or any deterioration due to dirt, scratches, stylus or tape head wear. Nor will we have to bother with such problems as anti-skating or hum induction.

Together with all these improvements there is a startling increase in the potential dynamic range. In truth, unless you have heard this system directly, it is just not possible to imagine all the above. And you can discount any previews you may have heard via FM transmissions. Such demonstrations are so severely limited by the FM medium that they are meaningless.

Incidentally, let us dispel a myth before it even has a chance to take hold. The greater available dynamic range will not mean that you have to play music even louder. Most people already play their music too loud. No, the greater dynamic range will mean higher fidelity on those instruments having transients which are presently "crushed" by analog recording and playback.

We predict that within 10 years, or perhaps even sooner, the Compact Disc will completely dominate home and car music systems and you will seldom bother to go back to those "archaic" discs and cassette tapes. It is an exciting future which can be looked forward to with great anticipation.

Leo Simpson

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* Recommended and maximum price only.

RED HOT SPECIALS

OVER 500 CERAMICS – 5 BUCKS!!!

Not your Asian rubbish either! Quality made in the USA, military grade units made by Corning. These devices are basically military style CK-12 devices (MIL-C-39012). They are very small, axial and are 10% tolerance. Values are mixed but range from 82pF thru to 0.022uF. They are very stable, long life units that sold in quantities to military contractors for up to 60 cents each. This offer represents outstanding value for money. Hey! Ceramics less than 1 cent each!!!

☆ ☆ ☆ **$5**

OVER 100 TANTALUMS – 5 BUCKS!!!

Once again, mil spec devices. Tiny long life and very high quality made in the USA by Corning.
We do not have many packs so hurry!!
Limit of 2 packs per customer.
Once again, less than 5 cents each!!

☆ ☆ ☆ **$5**

EA SOUND PRESSURE LEVEL METER

We have a small quantity of the EA Sound Pressure Level Meter PCB (81Sp5) & the pre-punched Scotchcal front panel to suit. For the month of Feb. only you can have the pair for $2.95 Normally the PCb alone sells for this.

☆ ☆ **$2.95**

JUMBO SPAGHETTI PACK

Genuine P.V.C. Spaghetti tubing. Always handy. From ½mm I.D. through to 13mm. Over 20m in all!!! Many colours. ONLY $3.50

JUMBO HEATSHRINK TUBING PACK

Amazing value. A huge bag of lengths of Heatshrink sleeving. At least 5 different colours in sleeving ranging from 3mm Ø to 32mm Ø. You will probably never need to buy heatshrink again.

ONLY $3.50

UGLY MES LAMP BEZELS

We cannot win. At one stage we had thousands of these. We slowly sold them off to manufacturers who somehow or other needed a bright panel mount pilot lamp. You know the lamp we mean. It takes a torch globe & has a glass multi-facet lens that looks like a cheap piece of costume jewellery Kitsch electronics. We recently bought a large consignment of manufacturers stock. You guessed it. We got em back! But at least they didn't cost much. Any redeeming features? Yes, they are well made & you can change the globe from the front panel.
$2 will get you 10 (mixed colours)
No other deals.

$2

½ KILO CAPACITORS

Staggering. Probably one of the greatest bargains we have seen.
Each bag contains: Electros, Ceramics, Styros, Greencaps, other plastic capacitors, Micas etc. We don't even know why we are doing this! No, we aren't giving away two 1950 style electro's at 250g each, it is not a con. You will (on average) get over 200 capacitors! Unfortunately, if you order this on its own we must charge $2.00 p&p — below cost anyway. Limit 1 per customer.

$4

You don't think sometimes. We saw these in an obscure part of our warehouse some time ago but did not think much about them. After idly playing with one on his bench one day our technician realised how fantastic they actually were. He'd dreamed of such a component in the past but never really thought that they were made. Basically this all metal device is a stereo 6.5mm (¼") jack. When a plug is inserted, however TWO SEPARATE single pole single throw switch contacts are opened. The switched contacts are isolated from the signal. Just imagine you can actually turn the appliance on and off simply by plugging in! No need for a separate switch! (Note that the contacts are normally closed and go open when a plug is inserted). Such a component would normally sell for about $2.95.

$1.00 THE ULTIMATE 6.5mm SOCKET?? (Limit 5 per customer).

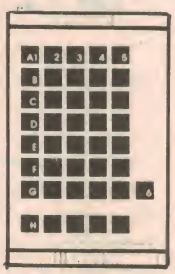
4116 RAMs 150nS – GOING CHEAP

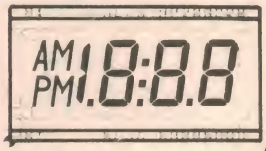
We have secured a quantity of 4116 (150nS) RAMs at a price which means great savings to you.
Why are they cheap? Well they don't actually have '4116' branded on them. They have '9016 FPC' on their little backs. They are used in a well known TV-game computer and this is the 'House Number' for their 4116. If you have ever had to buy a non-standard replacement part you will know that the 'House Number' part can be VERY expensive. We don't want to sell them as 9016 FPC's we want to sell them as 4116's — and at a great price. The normal (i.e. lower than most) price for our 250nS 4116 is $2.50 You can grab a 9016 FPC (150nS) 1-off for only $1.95!!!
For larger quantities see below.

This price includes sales tax!!

1-9 pcs $1.95
10-24 pcs $1.85
25-99 pcs $1.75
100+ $1.65

LIQUID CRYSTAL DISPLAY





☆ ☆ ☆ ☆ ☆

LCD's from less than a dollar each!!!
We have over 50 different types of LCD Displays. They range from 10mm high 6 digit displays to 75mm high single alphanumerics in both transmission and reflective styles.
In our January ads we said that we would have a list with each type and a description. Quite frankly, we did not have the time and space to do this. We are going to offer you an even better deal instead. TWO deals in fact.
DEAL 1 — You send $3.95 (plus p&p) and we send you THREE LCD Displays. That's right, made in the USA high quality displays for around $1.30 each. You will get 3 different displays. They could be alphanumeric (up to 3" high), dot matrix, or multi-segment numeric or — whatever!! The data manual with pin connections for most types will cost you another 50 cents.
DEAL 2 — You send $9.95 (plus p&p) and we send you TEN (10) LCD Displays. Some will be the same but most of you will see this as a benefit. You get the connection manual for ziltch.

HIGH QUALITY BARGAIN

Multimeter

MOVEMENT	8.7uA super high sensitivity meter
DC VOLTS	6 ranges 0.5 2.5 10 50 250 1000 Input Resistance 100K ohms per volt Accuracy ±3% of full scale all DC ranges except 1000V ±4%
AC VOLTS	5 ranges 2.5 10 50 250 1000 Input Resistance 10K ohms/V Accuracy ±4% of full scale all AC ranges
DC AMPS	6 ranges 10u 500u 5m 50m 500m 10A Accuracy ±3% of full scale all DC ranges except 10A ±4%
AC AMPS	1 range 10A ±4%
OHMS	5 ranges RX1 RX10 RX1000 RX10k RX100k (13 ohm mid scale) RX1 0 1k RX10 0 10k RX100 0 1M RX1k 0 10M RX10k 0 100M Accuracy ±3% of DC scale with full battery
FUNCTION SWITCH	+DC ohms AC, -DC, DC A, AC A, (+)V ohm A, (-)COM, AC 1kV, DC 1kV, DC & AC 10A
SIZE	135(h) x 172(w) x 86(d)
WEIGHT	1.27 kg

Incredible value for a high quality Analogue unit. We have secured a small quantity (less than 100) of the "STANDARD" ST-100 HNU Multimeter. This very same unit sells 'trade' for $72 + tax under a different name. Even if you could get it for $72 including tax you would be doing well. Our Price? Check the specs first.

ONLY ~ $59.95

THIS MONTH ONLY

HANIMEX

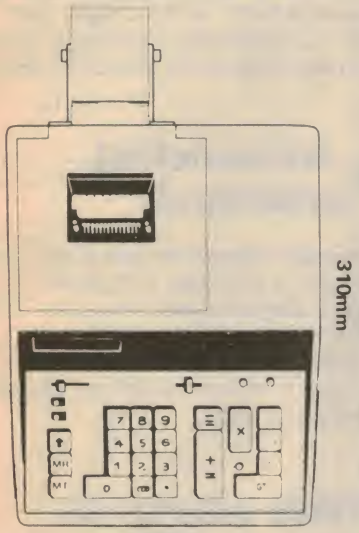
PRINTING CALCULATOR
– MASSIVE PRICE BREAKTHROUGH

- Quality Hanimex Brand Model MC 1500P
- 12 Digits, (12 Digit Print Plus D.P. Comma & Two Symbols)
- Seiko Printer
- Uses Standard Plain Paper Rolls (not expensive and hard to get Aluminium coated paper)
- Floating or Fixed Decimal Point
- Selectable % Mode, & most of the usual features found in machines costing well over $100!!
- A Real Accountant's Special
- Weighs over 3Kg!!
- Roll of Paper Supplied – available virtually everywhere.

Staggering Value

$59.50

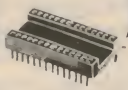
WE ONLY HAVE A SMALL QUANTITY OF THESE UNITS.
STRICTLY ONE PER CUSTOMER



28 pin IC skt.

We're stocked to the rafters with 28 pin IC sockets. What to do? Slash the price to clear them of course!
They are quality sockets made by Robinson Nugent of the USA. Each socket features tapered guides for unaligned pins and is a low profile design. The pins are tin plated. Normally we sell 28 pin sockets for 60 cents each, however for FEBRUARY ONLY you pay only 30 cents each!
(Minimum 10 sockets) but there's no limit. So Hurry!!

30¢ each min. 10



Stop ** Press

Disco strobes. 240V Mains powered. Not a kit. Built in a woodgrain (walnut) cabinet measuring 150 x 150 x 120mm. High efficiency wide angle reflector. 0 - 12 flashes per second fully variable. But that is no big deal. The big deal is the price.
NORMALLY $36.50
BUT because we get desperate in February ONLY $12.50 each!!

ALMOST 2/3 OFF!!
(Goods are brand new but reworked Q.C. controlled stock) . . . . . .

$12.50 Normally $36.50

POT PACKS *

Guess what? We've made more of these very popular packs.
In EA and ETI August last year we advertised packs of high quality European manufactured potentiometers. They sold quickly and we asked the question at the time "Will pots ever be this cheap again?" Guess what. We've done it. They are now EVEN CHEAPER than August 1982!

FAR CHEAPER IN FACT!!

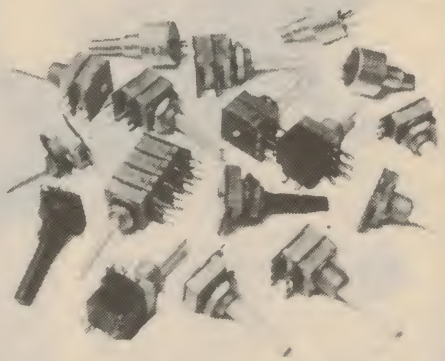
PACK No. 1 – Last year you got 50 assorted pots in this pack. This year you get over 75 pots for the same price. That works out at around 13 cents a potentiometer!

COST OF PACK – $9.95
Sorry p&p on this is $2.50

PACK No. 2 – This pack was selling fast when it contained 120 assorted pots. NOW it contains 200 potentiometers.

COST OF PACK – $19.95
WOW! Less than 10 cents per pot!
Sorry, p&p $4.50

NOTE: Each pack contains the same style of pot which includes: Single gang, dual gang, switched, unswitched, in log and linear. All pots have plain shafts to take grubscrew knob and most have a flat on the shaft. They have either PCB or solder eyelet terminals. They are brand new stock.



NEW

STAGGERING VALUE

$22 EACH
NORMALLY $24

Motorola twin element, controlled dispersion High Performance Line Source Tweeter. Model KSN1071A.
* Designed for flush mounting. No large holes to bore. * Less than 19mm deep will fit behind most grille panels. * Great in hot cars (Guaranteed unaffected at 99 degees Centigrade!) * Sensitivity 98dB @ 2.8 volts ½ metre * No need for a cross-over network * Response 4 - 40kHz (± 3dB) * Attractive built-in grille.

GE SMOKE & BURGLAR ALARM
The response to these products has been staggering. As a result we have virtually ran out of stock. If you still want one of these units, ring first, we may still have a few left.

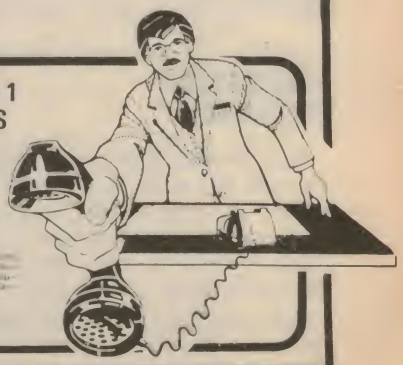
Jaycar

NUMBER 1 FOR KITS

125 YORK STREET SYDNEY 2000
PHONE 264 6688 TELEX 72293
'NEVILLES CORNER'
Cnr CARLINGFORD & PENNANT HILLS ROAD
CARLINGFORD
PHONE 872 4422 or 872 4444
MAIL ORDERS TO BOX K 39 HAYMARKET SYDNEY 2000

POST AND PACKING CHARGES
$5 $9.99 ($1.50) $10 $24.99 ($2.25)
$25 $49.99 ($4.50) $50 $99.99 ($6.50)
$100 up ($8.00)

Mail Order By BANKCARD
Via Your Phone



News Highlights

Home satellite receivers for $600, says Toshiba

Affordable home satellite receivers for the United States market are on the way from several Japanese companies. Toshiba Corporation has announced one such receiver boasting breakthroughs in cost and performance which should bring the price down to around $600 in production quantities.

In the United States, eight companies have already obtained approval from the Federal Communications Commission for direct broadcasting satellite (DBS) services, and at least some hope to start transmissions by the end of the year. Toshiba's prototype receiver and others from several Japanese companies are poised to open up a new large-scale market for DBS hardware.

The Toshiba home satellite receiver can accept video, facsimile transmissions, high-definition TV signals, digital audio, data transmissions and videotex signals. A compact unit is made possible because the signals will be transmitted at higher frequencies than conventional satellite communications.

The 12GHz signals used by DBS and the US Fixed Satellite subscription service require a dish antenna just one metre in diameter, rather than the four or five metre antennas of conventional satellite terminals.

Toshiba's trial model receiver has a small parabolic dish antenna with a low noise amplifier and down-converter fixed behind the dish. The indoor unit is about the size of an FM tuner and is used to select channels.

Reductions in the cost of the system have been made possible by replacing complex waveguides with a newly designed helix of copper-coated iron, the use of gallium arsenide monolithic amplifiers, and a proprietary surface-acoustic wave filter in the tuner unit. The filter can eliminate noise outside a given frequency band without using conventional capacitors and coils and is designed so that it needs no adjustment in use.

◄ Jet-launched spacecraft

A reusable spacecraft that is launched from atop a modified 747, then propels itself into orbit and lands like a glider? It's feasible by 1988, according to the Boeing company. The space vehicle could operate with or without a crew.

Private enterprise space shuttle

With potential profits looming large, private enterprise in America is making a bid for its own space shuttle. At least that's the goal of Princeton, New Jersey, economist Dr Klaus Heiss, who claims to have raised $1000 million from private backers for a fifth shuttle to add to the US government's planned fleet of four.

NASA, in fact, says that it wants a fifth shuttle craft, but White House budgetary restraints have all but ruled out the idea. Heiss proposes that his Space Transportation Company (Spacetran) would buy a shuttle from its maker, the Rockwell Corporation, and then lease it back to NASA. Spacetran's customers would pay the company for putting payloads into space, while Spacetran would pay NASA for the cost of the launch and other support costs.

NASA is reported to be considering the proposal seriously.

MICROCHIP FM RADIO

Readers should be on the look out for the first FM radio in a pencil, cigarette lighter or elegant watch following the European release by Philips of a single integrated circuit that combines almost all the functions of an FM tuner.

Measuring just 3.5 square millimetres, the new chip requires just a few external components — a resonant circuit, a power amplifier, and a loudspeaker or earphone. Power consumption of the chip is 9mA at six volts.

The chip will be produced at Philips' bipolar circuit factory in Hamburg, West Germany, and will be made available in both 18-pin dual-in-line and a 16-pin microminiature package. Volume quantities should begin to roll off the production lines this month.

WINDMILL REVOLUTION: This new concept in windmills could revolutionise wind-powered water pumping. It was developed by Mr Ken Cobden of Mildura, Victoria, and looks more like a jet engine than a windmill. Claimed advantages over conventional fan-bladed designs include greater power output, lower noise, and the ability to operate at extremely low wind speeds.

Cobden Wind Turbines Pty Ltd, Mildura, began manufacturing the new "wind turbines" on July 5th last year, and more than 70 orders have already been received.

New IC beats copyright pirates

CBS Records of the United States claims to have the answer to home copying and tapes – but whether it can be made to stick is another matter.

The device is an integrated circuit which would be built into all new cassette recorders to switch off the recorder when it detects a signal encoded on an LP or pre-recorded cassette. Obviously the device is a long-term solution; apart from the existing cassette recorders without the device, international co-operation and legislation would be required to force manufacturers to use the chip.

British commentators who witnessed demonstrations of the technique agree that it works, but point out that the chances of achieving legislation to force manufacturers to use the device were "pretty slim".

According to British reports the main use of the device may be as a "bargaining point" to back up the recording industry's claims for a levy on blank tape. Losses due to home copying are said to be around $A600 million a year in the UK alone.

Emergency aid for the disabled

"The Companion that will never start an argument" is how Vitalcall is publicising its new home alarm system. The "Companion" alarm is a close relative of "Vitalcall", a personal emergency system for the elderly and disabled.

Vitalcall summons help over the telephone when its portable transmitter unit is activated. Companion is cheaper, and does not use the phone, so there are no continuing costs except battery replacement. Like Vitalcall, Companion is intended to summon help in an emergency in response to pressure on a lightweight plastic pendant which contains a transmitter.

When the button on the pendant is pressed by the user, a signal is sent to the Companion unit which can be situated up to 200 metres away, perhaps in the home of a neighbour or friend. The signal triggers an alarm siren within the main unit which continues to sound until it is cancelled.

Each Companion unit uses a separate code, so the risk of interference between nearby devices is minimised.

Cost of the unit is quoted $195 and further details are available from Vitalcall offices in all capital cities.

Arms race spreads to microwave weapons

According to a recent report in the British magazine "New Scientist", the US Army is looking at the possibility of building microwave weapons to disable electronic equipment.

The plan follows concern that the USSR may already be designing its own microwave beam weapons, and follows a US Department of Defence warning that Russian work on very high peak-power generators "gives rise to suspicions of possible weapons intent".

The new weapons would work by disabling sensors in circuits by overwhelming them with electromagnetic noise – at least that's the general idea. For the time being, however, the main thrust of the Pentagon's work in this area will be to determine if microwaves can cause enough damage to be useful.

Assessments in this area will not be easy, though, since damage will depend on the amount of shielding and other countermeasures employed by weapons designers.

Practical weapons are, however, still far into the future, with the microwave program far behind the Pentagon's work on particle beam and high energy laser weapons. The goal of that program is a weapon in space that could serve as a defence against ballistic missiles.

High-power 1GHz field effect transistors

Field-effect transistors (FETs) able to produce tens of watts of power at frequencies in the gigahertz range should be available shortly. Present FET devices are limited to frequencies measured in hundreds of megahertz, but one US company, Acrian Inc, is ready to go into production with higher frequency devices.

According to Acrian marketing vice-president Mike Mallinger, a newly developed process will allow the company to build power FETs "that put out 50 to 100 watts (continuous wave) in the 500MHz to 1GHz range in the near future, with 150W at 1GHz not far off".

At present, the only power transistors able to operate at these microwave frequencies are bipolar devices, which have limitations. Most serious is the bipolar transistors' tendency to thermal runaway. The hotter the transistors become, the more they conduct, dissipating more power and heating them further until they are forced beyond safe operating limits.

FETs, however, have a negative temperature coefficient, conducting less as the temperature rises and avoiding thermal runaway.

Acrian's patented "Isofet" process has already yielded transistors which deliver 100W of pulsed power at 1GHz with a gain of 15dB, able to replace bipolar devices in radar, communications and electronic warfare applications.

What's new in robotics?

Toshiba Corporation of Japan has developed a multi-jointed robot arm said to be ideal for inspection and maintenance in complex and dangerous environments such as nuclear power plants.

The remotely controlled robot consists of eight arm segments, each with a universal joint. Touch sensors are mounted on each segment of the arm, and the tip carries a television camera. Total length is 225cm.

An integral part of the system is the software, called SAS, for "Self Approach System". Toshiba engineers believe that the range of movements possible in the arm make it too complex to be controlled by a human being without the assistance of a computer. The specially developed control program allows an operator to avoid obstacles in a confined environment and guides the inspection camera easily to any point.

The robot can move automatically in any direction along winding channels or tubes and reach around barriers. If required, the arm can be combined with an automatic vehicle, crane or hoist to enable it to cover a larger area, as in a power station.

Chief motivation for the development, according to Toshiba, is the urgent need to reduce down-time, and radiation exposure of maintenance technicians in nuclear power plants and reprocessing facilities. It is expected that the robot will be on the market by 1985.

How not to charge the patient

The increasing amount of electrically operated equipment in hospitals poses a new range of hazards and a number of accidents involving patients and operators have been reported in Australia.

Most accidents result from equipment which fails to comply with relevant safety standards, while others have been caused by the lack of proper precautions in the use of electrical equipment.

An answer is on the way, however, in the form of a new Australian standard: AS 2500, "Guide to safe use of electricity in patient care". The standard has been developed by an expert committee made up of representatives from the medical, nursing, manufacturing, engineering and biomedical professions.

AS 2500 emphasises the need for awareness of the various hazards encountered in health care institutions and contains specific guidelines for the safe use of electrically operated medical equipment.

While in the past more attention has been paid to the physical aspects of equipment and wiring, the new standard emphasises that the safety of patients and operators is equally dependent on the proper maintenance of equipment, and adequate education of staff.

The Standards Association report is intended for use by hospital administrators, doctors and nurses, engineers and all others concerned with the application of electrical equipment in health care.

New European broadcasting standard?

An Independent Broadcasting Authority proposal for a direct broadcast satellite standard for the United Kingdom may win out over the BBC's proposed "Extended PAL" system.

The UK government's technical advisory panel has recommended the adoption of the IBA's "multiplexed analog component" (MAC) system and its type C audio system, in which digitally encoded sound is transmitted during the line-blanking interval. The system resolves incompatibilities between the PAL system used in the UK and the French SECAM system, a major point in any European standard for direct broadcast satellite television.

Canadians examine the "information revolution"

A Canadian government task force has recently produced a report on how the "information revolution" will affect workers, and makes a number of interesting recommendations.

Issued by Labour Canada, the Canadian ministry of labour, the "Report on Microelectronics and Employment" suggests that increasing use of computers will bring benefits, but that pitfalls and social upheaval may result from introduction of new technology.

The task force suggests that there will be problems "generating enough new employment to compensate for possible short-term job displacements". Many of the jobs created by automation will require skills which are not possessed by the workers who are made redundant, says the report.

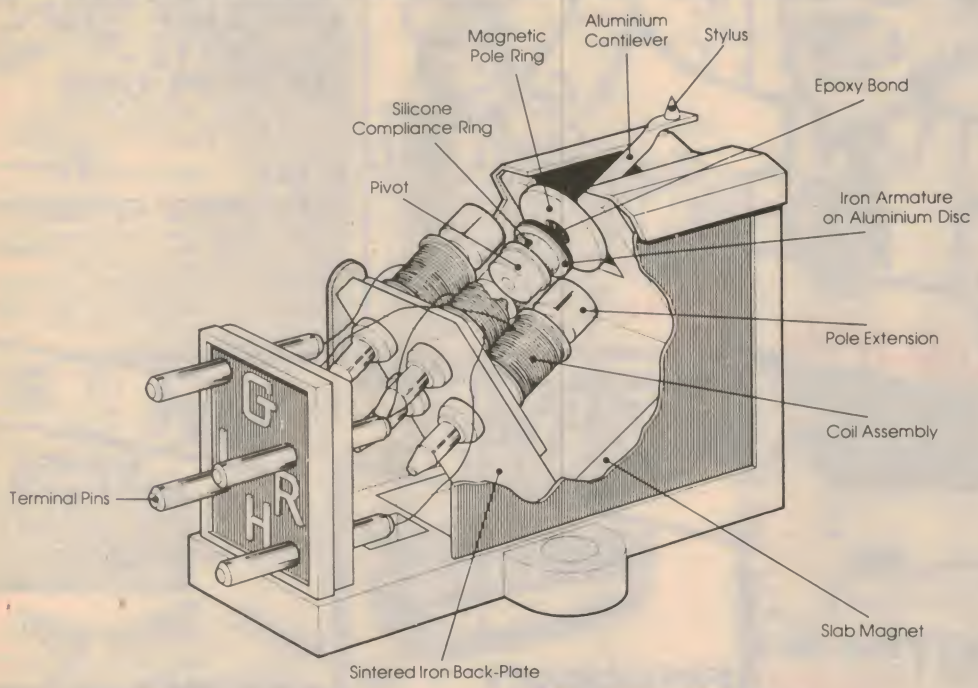
Women, who now carry out the majority of information related tasks, will be especially affected by office automation. According to the report, "women are particularly vulnerable because they are clustered in a few jobs such as clerical, sales and service positions which are the main targets of office automation".

To prepare for these social changes the report recommends the creation of a national "Centre for Technology, Work and Human Priorities" which would focus on job creation, monitor the effects of computerisation and publicise research work.

Concerning the fears voiced by many workers on the health effects of video display terminals (VDTs), the report stated: "currently the gravest worry is that radiation from VDTs is the cause of an unusually high incidence of miscarriages and/or children with birth deformities born to women who during pregnancy worked with VDTs".

Although the task force found no data suggesting a basis for such fears, it suggests that employers take precautions until further research is carried out. The task force suggested that pregnant VDT operators be allowed to take other positions, not involving the use of VDTs, without loss of pay, seniority or work benefits.

Electronic monitoring of an employee's work (such as computer checking of the productivity of a VDT operator) should be prohibited, according to the task force, "as inconsistent with human rights".



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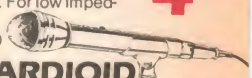

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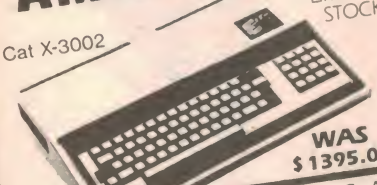

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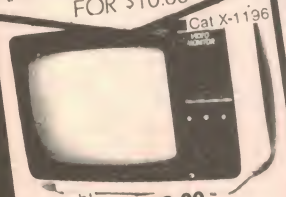

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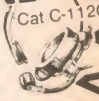

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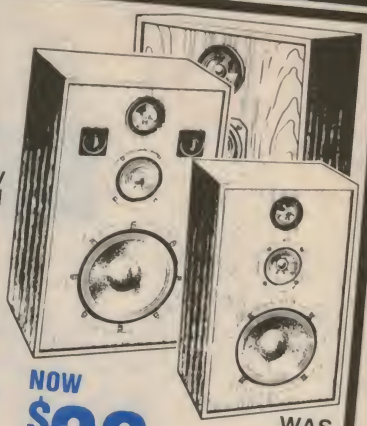

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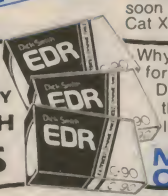

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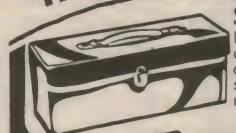

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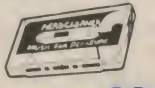

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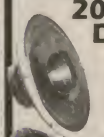

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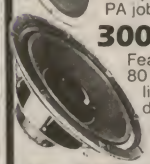

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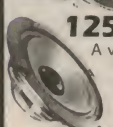

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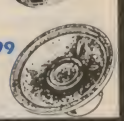

This fantastic low cost speaker has many uses for the hobbyist, experimenter etc. etc. Cat C-2222

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SEE PAGE 98 FOR FULL ADDRESS DETAILS.

THE GROWING PERIL OF SPACE DEBRIS!

Unwanted space debris is posing a growing threat to satellites and to the Space Shuttle. On the evidence available, one Russian satellite has already been destroyed.

by JIM SCHEFTER

HANGING LIKE a fishing float in a still pond, the Russian navigation satellite Cosmos 1275 swept quietly through empty space in the last moments of its short existence.

Shortly after launch on June 4, 1981, it had become operational. Now, 50 days later, routinely circling in its near-polar orbit 960km high, Cosmos 1275 sliced across the arctic tundra over northern Alaska.

Then came the unthinkable. Experts suspect that a nearly invisible shard of metal flashed from the void. The explosive impact shredded Cosmos 1275. In a fraction of a second on July 24, 1981, a working spacecraft turned into more than 140 pieces of orbiting junk.

The Kessler Syndrome – a moving layer of space garbage whose flotsam can lead to disastrous collisions in orbit – had almost certainly claimed its most significant victim.

"It's speculation because no one could see it happen," a West Coast expert in the field, who also described the craft's probable shape, told me. "But of possible collisions in the past, this one is the strongest candidate.

"We think it was a gravity-gradient satellite with no thrusters or fuel tanks on board. (A gravity-gradient spacecraft orients itself by responding to changes in gravity. The Russians have never released technical details on their navigation satellites.) Its mission was navigation, so it carried nothing that could explode. And it was working normally until something happened that broke it apart."

Another expert who analysed the trajectory data agreed. "There is a good possibility that it was a collision, not a simple explosion," he said. Both investigators asked not to be identified; even though the details of the Cosmos 1275 incident are not secret, other elements of their work are classified.

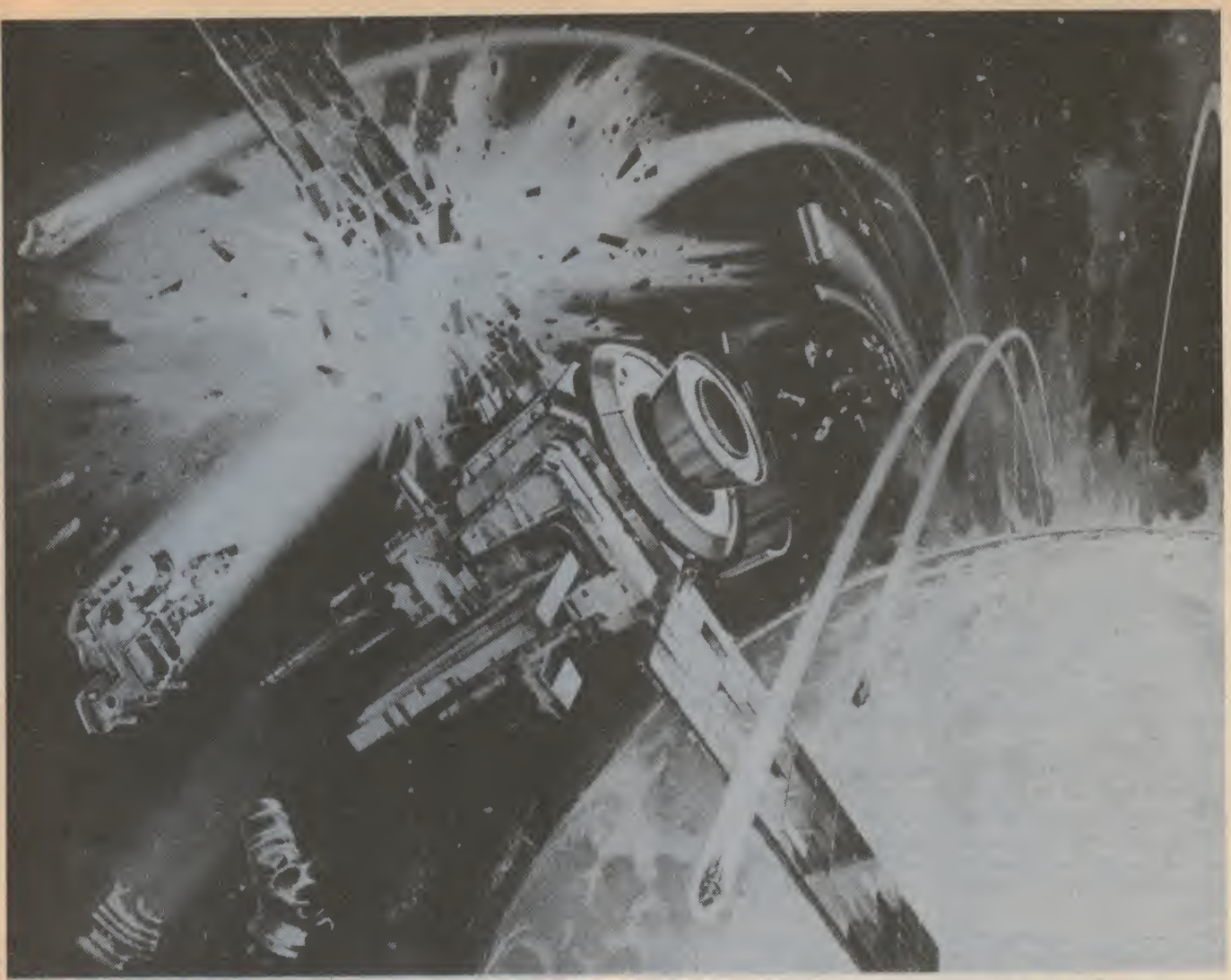
That event is just one in 1981 that is helping to feed a new and growing concern about debris in space. Both NASA and the US military now have active investigations into the hazards of accumulating space debris. The potential threat to the space shuttle, large space platforms of the future, and smaller satellites now in orbit will only get worse.

To get the story about this mounting problem, I talked to experts at Johnson Space Centre in Houston, the North American Aerospace Defence Command (NORAD) in Colorado Springs, the Air Force Space Division and the Aerospace Corporation, both in El Segundo, California, and others. Here's what they told me:

- Nearly 5000 orbiting objects, ranging in size from a few centimetres to complete spacecraft and rocket bodies, are catalogued and tracked by NORAD. More than half of those objects are debris from explosions. Others are protective clamshell shrouds ejected from payloads, pieces that have torn away from tumbling satellites, objects ejected deliberately, and unknown items suddenly "spawned" from other objects. A new report says that another 5000 untracked, but still dangerous, objects are in orbit.
- More than 70 explosions or "fragmentations" have occurred in space since 1960. Some were deliberate, including 19 Russian anti-satellite tests. But most weren't. Of these, 10 were derelict US Delta rocket second stages, some exploding nearly three years after completing their missions. At least seven explosions of all types occurred in 1981 alone.
- Collisions are increasingly probable. Two other Russian craft may have spawned pieces from collisions, but the evidence is circumstantial. A deflated US communications reflector balloon named PAGEOS probably was fragmented by collision in July 1975, but, again, absolute evidence is lacking.
- Near misses (objects passing within 50km of each other) are increasing. At least two satellites were put under special watch in 1981 when NORAD radar data predicted closest approach by debris to be less than 900 metres. At geosynchronous altitudes alone (35,000km) there were 120 near misses in the last six months of 1981. Two active communications satellites passed within 10km of each other in April 1980
- Microscopic fragments of junk also orbit the Earth. Pits found in Apollo spacecraft windows and a Skylab window brought home for analysis showed traces of aluminium that could only have come from a manufactured item. The finding causes concern for future instruments, such as large telescopes, whose optics could be degraded.
- Improvements in tracking and surveillance are needed. A new NORAD high-quality optical surveillance system will be operating soon, and NASA is studying an orbiting sensor system that could become a "picket fence" in space.

"We've created a debris belt in orbit around the Earth," astrophysicist Don Kessler of Johnson Space Centre in Houston told me. His pioneering studies laid the foundation for most current work in the field.

"People used to contend that space is self-cleansing," he



In this artist's conception, a future space satellite is shattered by a hail of lethal space junk.

explained. "In fact, the low-altitude particles do decay into the atmosphere, but they're constantly replaced by particles from higher altitudes.

"There's a rain-down effect of debris in orbit."

That effect is unofficially dubbed the Kessler Syndrome by the growing number of experts concerned about the hazard. Even the conservative American Institute of Astronautics and Aeronautics recently issued a strongly worded paper on space debris, urging immediate action on several fronts before the problem becomes unmanageable.

The Delta rocket explosions already were being examined. Engineering detective work at the McDonnell Douglas Astronautics plant in Huntington Beach, California, where Delta is built, traced the probable cause to the common bulkhead between the hypergolic fuel and the oxidiser. (Hypergolic fuel ignites spontaneously on contact.) A 100kPa pressure difference could rupture the bulkhead.

In a typical mission, the Delta vent valves were closed after a payload was deployed. Floating derelict in and out of sunlight could cause pressures to build up until the bulkhead blew, as one did on January 27, 1981, over Edith Range Land, Antarctica. That Delta had been in space nearly three years; others exploded in as little as a day.

Once the problem was isolated, McDonnell Douglas knew what to do. "We changed the software to move the stage away from its payload, then fire the engine until it burns to depletion," said Delta Program Manager Louis Rayburn. "Then we left the valves open to vent any residual propellant."

It seems to have worked. Recent Deltas have not blown. But some older stages still in orbit may yet contribute to the growing volume of debris.

"Most of the Delta explosions come in the 1500km altitude range," Kessler said. "There's a peak in the debris concentration there and that's the source of a lot of stuff raining down to lower altitudes."

Another and heavier debris concentration is found about 800km up, according to Vladimir A. Chobotov, manager of the Space Hazards Office at the Aerospace Corporation. Much

What's in orbit

Natural and man-made objects in space include the following:

- Planets, moons, asteroids, meteroids, and other natural bodies.
- Operational payloads.
- Nonfunctional mission-related objects, such as rockets and stages of rockets, shrouds, clamps and fasteners.
- Fragments resulting from explosions and collisions.

The nonoperational payloads, nonfunctional mission-related objects, and fragments are generally referred to as debris or "space junk".

of that may be remnants of Soviet anti-satellite tests. Russian "hunter satellites" explode within about 8km of their targets, spraying large amounts of shrapnel into the area.

That belt is within the altitude limits of the space shuttle, though not for a typical mission. But debris does filter down into the shuttle's primary operating altitude range.

"The hazard increases with the square of the radius of the spacecraft," Chobotov explained, "and right now the problem is not severe."

Chobotov calculates that a shuttle at 275km altitude will have 67 encounters (within a distance of 200km) with objects larger than one metre during a four-day mission. The probability of collision: a million to one.

"But there are many more small objects raining down through this area," he cautions. "We may need much more space-traffic control in the future."

And the number of objects up there is growing every year. NASA's Kessler believes that collisions themselves, mostly between pieces of junk, will be the major source of debris within 10 years.

Kessler did more than examine the actual debris hazard to active spacecraft. He looked at the way the debris belt propagates itself. Citing tests in which tiny fragments were fired at high velocity into metal blocks, he said that any collision produces a large number of new fragments. Each of these travels in its own orbit, gradually spreading out across space.

In one test, a 1.5mm glass sphere was fired into a 6mm thick aluminium plate at about 7km per second velocity. The sphere left an impact crater eight times its own diameter.

In another test, a bean-size pellet weighing about six grams was fired into a 500 gram aluminium block about the size of a brick. The block was destroyed, with new fragments scattered about.

A spacecraft weighing only 450kg could produce a million tiny fragments upon collision, Kessler said, though a few hundred seems to be the more common number. "The most probable point for collisions is where orbits intersect," Kessler said, "and the impact velocities can be from zero to about 15km per second."

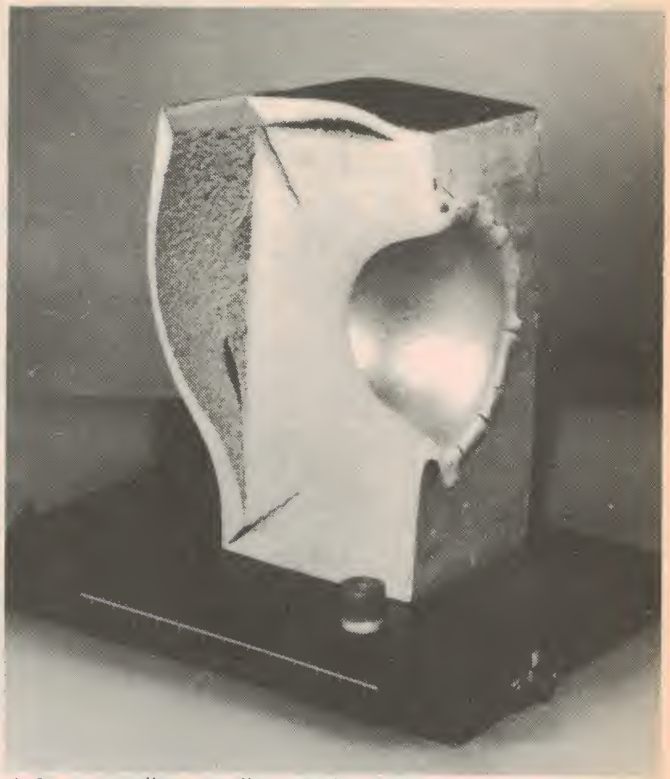
"There's a significant probability of a large object getting hit. If we had 10 platforms in space, each 100 metres across, one would get hit every year"

Thus the polar regions, where large numbers of surveillance satellites in north-south orbits constantly cross, and the geostationary nodes used by communications satellites could become danger zones. Many of the Delta fragments are in polar orbits.

With so many pieces in space, NORAD does well to keep accurate records. "For routine maintenance of an orbit, we attempt to get six observations per day," Lt Col Peter H. Roe, chief of the Command Control Systems Division, told me. That includes active satellites, particularly on military missions, and other pieces of interest.

For all objects below the 4800km altitude, NORAD attempts to get one data point per day, Roe said, and objects about to enter the atmosphere can get continuous, horizon-to-horizon tracking by NORAD sensors.

The space shuttle also gets NORAD's full attention. The shuttle's orbital path is fed into computers and constantly



A 6 gram pellet travelling at about 7km per second cratered this aluminium block.

compared with all known objects along the way. "We run a protective net out ahead of the shuttle by six to 12 hours," Roe said. "It's a major task for our computers."

If a near miss is predicted, NASA is notified immediately. The same service may be available, on request, to other satellite operators. But NORAD stresses that all tracking data are subject to error, particularly for objects only observed once a day.

"It may be accurate to two kilometres, plus or minus 40 kilometres," Roe said. "You don't know within two kilometres exactly where a satellite is. You're dealing with mathematical averages,"

All data is fed into NORAD's command centre in huge tunnels and caverns carved under Cheyenne Mountain near Colorado Springs. There, banks of computers constantly sort the information, maintaining records of space debris that can be rapidly distinguished from missiles or other attack weapons.

The NORAD complex, occupied in the late 1960s, is a self-contained command centre shielded from nuclear attack by hundreds of metres of granite. I visited the complex recently.

We reached the first checkpoint by bus, driving through a 400m tunnel. From there, we walked, penetrating always deeper into the underground maze. Behind us, two massive blast doors, each one metre thick and weighing 25 tonnes stood ready to slam closed within 30 seconds of an alert.

Blasting out the nearly five kilometres of tunnels, some nearly 12m high, began in 1961. Inside those tunnels NORAD built 15 steel buildings, most three storeys high and all supported on huge coil springs and shock absorbers. The delicate computers, communications equipment, radar electronics, and other gear installed in those buildings are well protected against the shock of a direct nuclear hit on the mountain.

Rounding the corner of a tunnel, I found myself staring into

the blank steel side of the first three-storey building about 50m ahead. Moments later, we were inside a conventional government-issue building, and it was easy to forget that we were under a mountain. For the next few hours, we looked at electronics shops, computer rooms, even a dispensary and cafeteria.

But most of our attention went to the command centre, a room filled with consoles, screens, message boards, and a communications system that connects the NORAD commander and his staff directly to the White House and all military commands.

The NORAD inventory includes both radars and optical devices, such as the fabled Baker-Nunn cameras that have served space watchers well for decades. In lower orbits, pieces only a few centimetres across can be spotted. At geosynchronous orbits, objects one metre across can be seen.

A new system called Ground-Based Electro-Optical Deep Space Surveillance, soon to be operating at four globe-spanning sites, will improve that significantly. The surveillance system focuses sensitive vidicon cameras through large astronomical telescopes, then feeds the light measurements in digital form to computers.

The result is a display pinpointing anything moving across the star field at altitudes above 4800km. Objects as dim as magnitude 16.5 can be identifed. That's the equivalent of finding a soccer ball 35,000km up.

Using the NORAD orbital data, two of the command's senior analysts have made widely respected contributions to determining the sources of orbital debris and to analysing the potential for collisions. Preston Landry and John Gabbard sparked major improvements in computer programs that backtrack orbital paths to determine what object fragmented, and where.

Gabbard has also looked at several suspicious events to determine whether they were explosions or collisions. "We've never had a problem figuring out what object fragmented," he told me, but deciding how it did is harder.

It takes deduction and speculation to find good candidates for collisions. One was PAGEOS, a 100-foot balloon inflated in orbit in 1966 and used to reflect radio signals. By 1975, PAGEOS was a partially deflated object of little interest.

That changed when the inert balloon suddenly showed up in NORAD tracking as more than 70 separate pieces. If an object pierced the balloon, Gabbard reasoned, there should be two separate sets of fragments – one moving out from the entry hole and one from the exit hole. Computer runs pointed to that possibility.

Gabbard even found a potential suspect for the impacting object, a small piece of an old satellite that was the only object in the area. That piece was never found again.

Yet the evidence is not perfect because tracking is not perfect. "Imagination and speculation can either lead you to an important conclusion or get you in trouble," Landry said of trying to pinpoint space collisions. "Without considerably greater capability than we have, it's going to remain speculation."

Deeply concerned over the growing risk of collision, NASA has put the General Electric Corporation to work evaluating instruments for an orbiting picket fence of sensors that would track debris in the realm where the shuttle flies.

"We're looking at three types of devices," GE's Sherm Neste said, "radar, lidar, and passive optical systems." In each case, the sensors would be put aboard spacecraft oribiting between 290 and 1000km and would monitor the amount and trajectories of particles from 0.1cm to 10cm. "We're emphasising the smaller sizes because ground radars can see particles down to the 10cm size," Neste said. "We want to add to the information available, not merely duplicate it."

Each flight of the Space Shuttle is continuously tracked by NORAD and its path compared with the orbits of 5000 known pieces of space debris.

A space-borne radar with that capability would have a two-metre dish, Neste said. Because debris moves at such high speeds, the dish would not be swivelled. Instead, the radar beam itself would be steered electronically to follow its target.

Lidar, or laser radar, also is being considered. It is slightly smaller and easier to steer, but problems may exist in actually getting such a radar to work in space.

The third system, Neste said, would use passive optics, either charge-coupled devices or charge-injection devices viewing through three or four telescopes with overlapping fields of view. Any particle passing through that field would be spotted by its reflected sunlight.

"Objects in space are very bright," NASA's Kessler told me. "In sunlight, a one-centimetre object at one kilometre looks like a magnitude-one star."

Each sensor would see all debris in its area out to ranges of five to 10km. The data collected would let NASA finally determine what steps to take to protect its space-going people and machines.

Kessler heads the team that will examine the GE work through the latter part of 1982. A contract then may be offered for competition, with a prototype instrument flying aboard the shuttle in about 1987.

"The problem isn't critical today," Kessler said, "but it's time to be looking ahead. There's a significant probability of a large object getting hit. If we had 10 platforms in space, each 100 metres across, one of them would get hit every year."

The American Institute of Astronautics and Aeronautics paper on space debris, looking ahead to the increasing hazard, put it bluntly: "Corrective action must begin now to forestall the development of a serious problem in the future."

Electronics Australia exclusive interview

The prospects for cable television

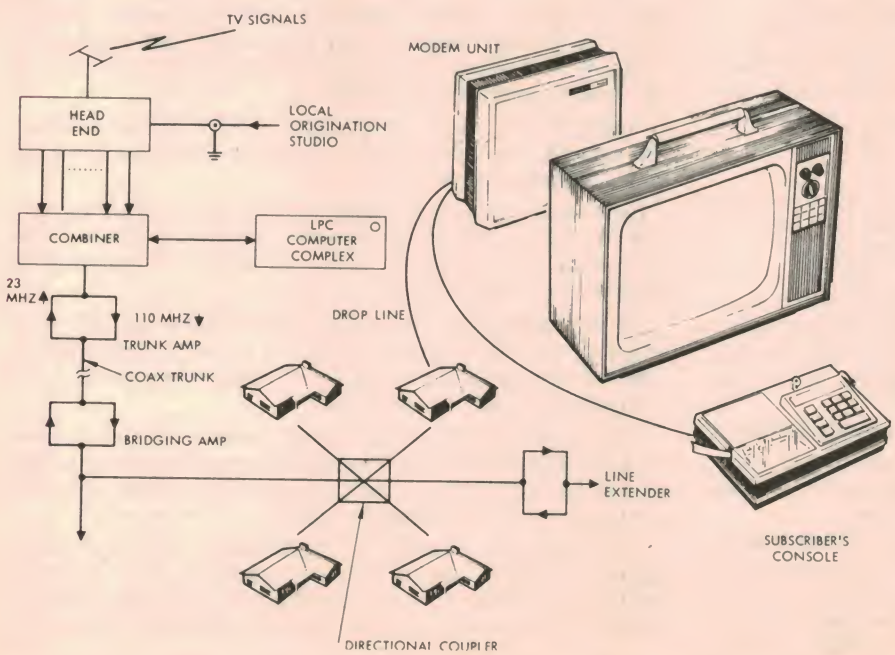
Following the recent two day conference in Canberra on cable television, organised by the Australian Cable and Subscription Communications Association (ACASCA), "Electronics Australia" was privileged to have an exclusive interview with one of the leading speakers at the conference, Mr Lionel Mudd, Development Manager of Rediffusion Engineering, in Great Britain.

by PHILIP WATSON

ACASCA represents a group of private companies interested in the commercial aspects of cable and subscription television. They include Amatil Ltd, Elders-IXL Ltd, Hills Industries Ltd, Myer Emporium Ltd, Neilson Premiere Ltd, Stereo FM Pty Ltd, and Philips Industries Holdings Ltd. They were all hoping that the Minister for Communications, Mr Neil Brown, a guest speaker, would announce government approval for cable and/or subscription television.

In the event, no such announcement was forthcoming, leaving the political side of things very much in limbo. But at least one aim of the conference was achieved; it allowed a wide range of opinions to be expressed, both for and against, with some surprises. American news commentator, Mr Walter Cronkite, the "keynote speaker", provided one of them. If he is to be believed, the last thing Australia should do is aim for anything like the American cable scene as it is today.

But there was more to the conference than politics. The engineering behind cable systems is vitally important in terms of what facilities can be provided, at what cost, and with how many options of cost versus facilities, room for expansion, etc.



A typical cable television system may consist of a local switching centre, a trunk cable and couplers for individual homes. The home console selects channels.

In short, if the government does make a favourable decision, what kind of system should they recommend? The British government is in the process of making a similar decision and Mr Mudd's address outlined the kind of service, in the technical sense, that has been recommended in that country. At the very least it could serve as a basis for an Australian government decision.

By way of background, the company Mr Mudd represents, Rediffusion, started out as a radio program cable distribution organisation in the late 1920s and, in 1949, decided to branch into cable distribution of TV programs. It was as a result of this decision that Mr Mudd joined Rediffusion in 1950.

Rediffusion's other interests include computers, flight simulators, communication receivers and transmitters, and similar specialised equipment, as well as TV receivers for the domestic market.

One of Lionel Mudd's first jobs on joining Rediffusion was to help install a cable TV system in Montreal in 1951, before Canada had a TV broadcast service, which distributed programs received off-air from across the US border.

Another installation was in Hong Kong, again before there was a TV broadcast service in that part of the world, and this attracted 120,000 subscribers. The system was based on the original British 405 line system, and was ultimately superseded by a 625 line broadcast system.

Cable systems were also much in demand in Britain before the country was adequately covered by broadcast transmitters. As more transmitters were installed, so the need for cable systems has fallen off, since, at present, these systems can only re-distribute programs off air.

But Britain is currently considering expansion of the cable system,whereby it would become a program source in its own right, and Mr Mudd is one of those chosen to advise the British Government on the technical and other implications of such a system.

And he would appear to be well

qualified to do so. He is chairman of the British National Committee on Cable Television, chairman of the International Technical Committee on Cable Television, has been president of the Society of Cable Television Engineers in UK twice, and is chairman of the Papers Committee set up to advise the government. Within Rediffusion he is Development Manager and Deputy Director of Research.

One of the first questions I asked Mr Mudd was whether he could give any idea of the cost of installing a cable TV system in, say, Sydney or Melbourne. As I half expected, this turned out to be a "how long is a piece of string?" question, if only because there are so many variations on the type of system which might be selected and the actual methods of distribution.

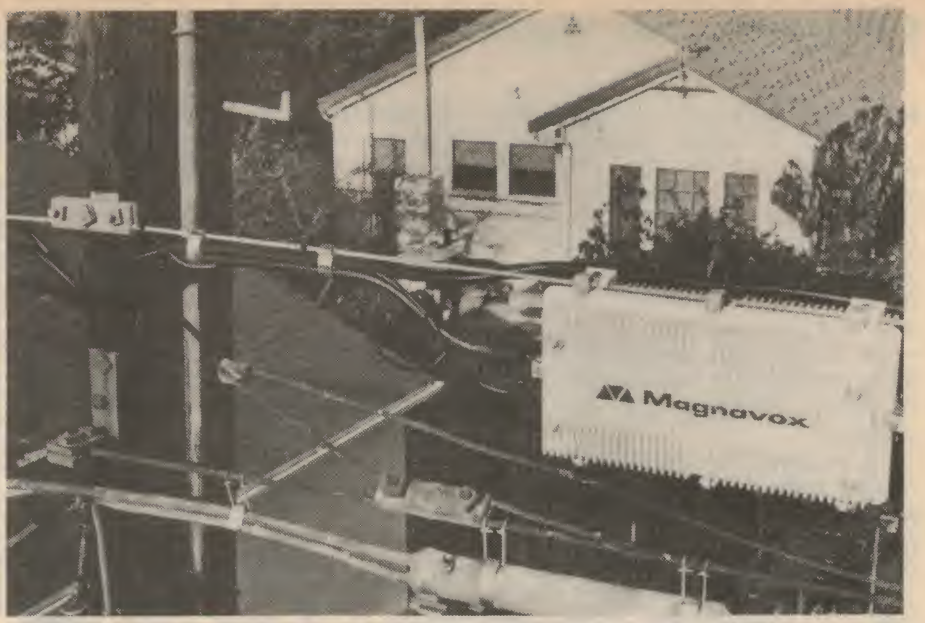
The best he could do was to repeat the answer he gave to an entrepreneur who approached him after the conference with the same question. After qualifying the type of installation and the city involved (not Sydney) the answer was: "It could cost you $1000 a home". Interestingly enough, the questioner did not seem to be unduly shocked at that figure. On the contrary, he commented that it could be a worthwhile investment. As a sidelight to this, Mr Mudd pointed out that, technically, cable television is not new to Australia. There are Australian companies who have been making cable television equipment for years; and exporting it. So, as he put it, "You don't have to import Poms or Yanks to tell you how to do it."

"And," he added, seeming to echo Walter Cronkite's thoughts, but on a technical level, "It is my belief that using American technology is not necessarily the way to go."

He then went on to talk about the Hunt report in the UK, which recommends a cable TV network with a capacity of 30 channels and having interactive facilities.The interactive facility is one whereby the subscriber can,via a keypad (similar to those for TV receiver or VCR remote control), "talk back" to the system.

The system would not necessarily be confined to 30 TV channels, nor would all the TV channels be used for entertainment. Some TV channels would be used for educational programs, and additional cable capacity would be used for FM sound, access to a central computer, data banks, teletext type information etc. The interactive keypad could even be used to call for help in an emergency.

Two possible distribution systems have been suggested for such a service. One, currently in use in most countries, is sometimes called the tree structured network. Signals are distributed first via a trunk, then via branches, until it finally reaches the leaves (individual homes). In this system all the channels on the network are brought into every home.



This Interactive Data Exchange Module (IDEM) processes program commands from subscribers and distributes cable services to up to 32 subscribers in its area.

Cable may open the way for high definition television (HDTV), requiring receivers such as this NHK/Matsushita high resolution monitor.

This normally means that a converter must be provided in every home to interface with the TV set and there may be other facilities, such as decoders for scrambled signals etc. It all adds up to the need for an expensive, complex piece of equipment in each house, with the risk of tampering, theft of service, or loss of equipment.

An alternative approach is the "switched star" system. In this system bulk signals are delivered to switching centres and, from these, individual cables are provided for each subscriber. This cable can carry up to three TV signals at a time, and the signals required are selected at the switching centre on instructions sent to it from the subscriber's key pad. There is a minimum of equipment in the home.

Another advantage of the star system is that it becomes relatively simple to change the mode or frequencies of the bulk signal transport network, should this become necessary or desirable, without seriously disrupting the subscribers' cables or equipment. In fact, he may not even be aware of such a change.

There are a number of frequency bands and modes available for both bulk and subscriber distribution. A typical arrangement, as suggested for use in the UK, proposes a star system with bulk distribution at VHF and subscriber distribution at UHF, the latter being

essential to suit British TV sets anyway.

The bulk distribution would be via a seven tube coaxial cable. One tube would probably be devoted to FM and similar services, and the remaining six tubes would each carry five VHF TV signals, making 30 TV signals in all. Each tube would use the same five VHF channels. From the switching network, one cable to each subscriber would provide three channels into which would be fed whatever programs the subscriber selected.

At this point I raised the matter of relative costs. Was it more expensive to provide separate cable for each home, rather than have everyone tap onto a common cable?

Strangely enough, there isn't a great deal to it. Assuming that all the cables are laid underground – which is strongly recommended, for several reasons – then the digging of trenches is likely to be the major cost. The additional cost of individual cable to the switching centre is small, and would be offset by having less equipment in the subscriber's home, and other advantages.

Only where all the cables are run above ground, on existing poles, does the tree structured system come out significantly cheaper than the star system.

The next point I raised, prompted by the thought of overhead cables, was that of interference either into or out of the cable system. I reminded Mr Mudd that, in the US particularly, there have been a lot of problems caused by the cable systems including the two-metre amateur band in the channnels they use. Leakage, usually at junction boxes and other couplings, allows the TV signals to interfere with amateur signals and amateur signals to interfere with the TV signals.

Mr Mudd agreed that this problem was a serious one, and one of which he was very much aware. Two main factors contribute to this in the US. One is that many VHF cables are run above ground, and the other is the almost universal use of aluminium jacketed coaxial cable.

He pointed out that it is virtually impossible to make an effective, permanent connection to the aluminium jacket, no matter how elaborate the clamp or gland used. Oxide invariably forms in a short time, and interference results. For this reason, plus the asthetic aspect, he strongly recommends placing all cables underground. (Just imagine the damage that parrots could do to overhead cables . . . Ed). And, obviously, copper jacketed cable would be preferred.

This led naturally to the next question; would optical fibres, as advocated by US and Australian amateur organisations, be a practical solution? Mr Mudd agreed that optical fibres have many advantages, including their immunity to interference problems, but they also have their problems. Even so, he considered they would be suitable for trunk circuits from the inner to the outer distribution areas.

The main problem with optical fibre techniques concerns the interfacing devices; the lasers which are modulated by the TV signals and the photo-diodes which are used to convert the light impulses back into electrical signals. Both devices are markedly non-linear, meaning that relatively complicated and expensive compensating circuits have to be provided at every electron/photon junction.

One approach is to convert the signals to a digital format, but this is economical only for relatively long runs with few branches and, therefore, few analog/digital conversion stages.

Another subject we discussed was high definition TV. The US and Japan are currently experimenting with an 1125 line system, using a 5/3 aspect ratio screen as provided by either large picture tubes or projection. (A full report was given in "Electronics Australia's" companion magazine "VideoMag" for October/November 1982.)

Mr Mudd had seen this system demonstrated in Japan, and described part of the demonstration. "We were shown a film of a Mongol horde, mounted on their ponies, charging at the camera. The high definition image, on the 5/3 ratio screen, produced such a sense of immediacy that I ducked! Once people see it, they are not going to be happy with the old system any more."

But getting it to people is the snag. With a bandwidth in the region of 30MHz these signals can not be broadcast in the ordinary way. Various satellite schemes are under way, but these have a long way to go. In the meantime, cable is one obvious solution. It could easily cope with such signals and deliver theatre quality wide screen pictures right into the lounge room.

Optical fibre may be an alternative method of distribution for cable TV. The six-fibre ITT cable shown here (centre) has more capacity than both larger copper cables combined.

What about content?

The final point I raised, and one which I think concerns everybody, is the suggestion that, as we increase the number of channels, there is a very real risk that the quality of the programs will drop in proportion.

Initially, perhaps tongue in cheek, Mr Mudd protested that, as an engineer, he couldn't have a view on that. Then, more seriously, he went on to suggest that it was all a matter of discipline and, ". . . not just because I'm a Pom visitor – I'm a very willing Pom visitor – the general air of responsibility in Australia, particularly as indicated by a lot of the papers given at the ACASCA conference, is such that, if a high capacity cable television system is going to succeed anywhere, it will succeed in Australia."

Well, that remains to be seen. Right now there is some doubt as to whether we are going to have a chance to find out immediately. But, if we do, let's hope Mr Mudd's confidence is justified.

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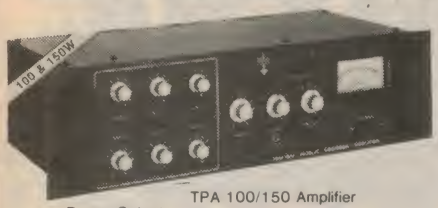

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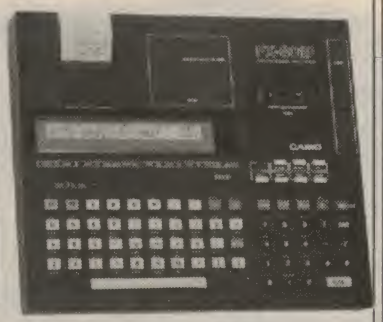

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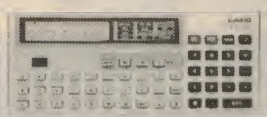

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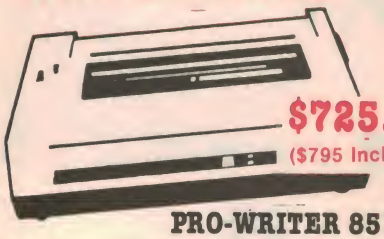

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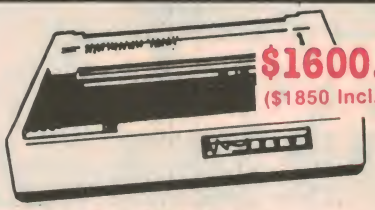

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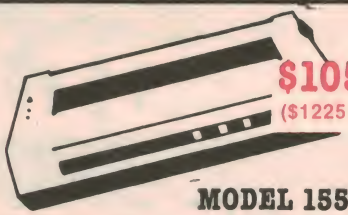

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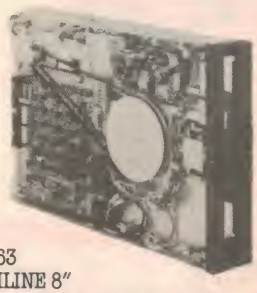

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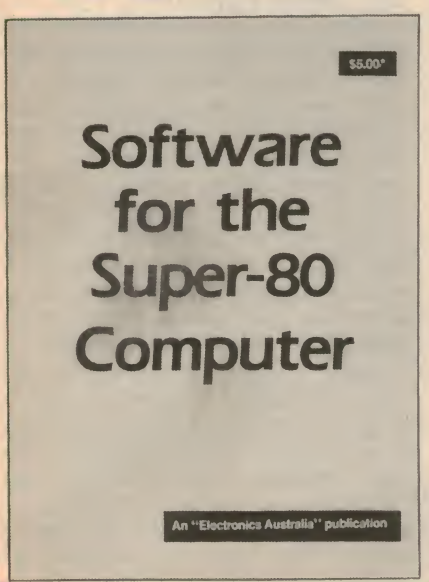

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Jack O'Donnell's Altronics

the live-wire company from the Golden West

This issue of "Electronics Australia" features a 48-page catalogue from the West Australian company, Altronics. As you might imagine, such a large catalogue costs a fortune to compile and insert in this magazine, so proprietor Jack O'Donnell wanted a little more for his money. As a sop to Jack, we allowed him to write this boring piece about himself and his operation.

Seriously, though, Altronics has proved to be a dynamic electronics retailing company with rapid growth in the last few years. Altronics has four main activities: a retail shop and showroom, a mail order centre, kit department and an import/wholesale division. A particular feature of Altronics is its very fast mail order operation which we can certainly vouch for. But, as we said, we'll let Jack tell his own story.

This is the hub of the Altronics operation – the retail and mail order centre at 105 Stirling St, Perth.

The Beginning

"The beginning you ask? Er, well yes, I suppose it was at the tender age of 14 when I built my first project – you guessed it, a CRYSTAL SET! It worked too. When was this? I'll give you a clue, the OC44 was all the rage and cost a mere four pound, six shillings and five pence – which was a full week's wages for a 1st year apprentice! Today you can get around 700 BC548s for the equivalent real dollars.

"After I left school, I spent five years as a technician-in-training at the rather excellent Radio Training School in Perth run by the then Department of Civil Aviation (and what's more, they paid me as well). Apart from the comprehensive grounding in electronics the DCA school provided, they tended to heap praise and promotion on the neat and tidy conformists and completely overlook untidy, troublesome budding genuises like myself. So eventually, as no one seemed to notice my unique qualities, I quit.

"Starting off in business was tough, a lot tougher than I had ever dreamt. My business was in the manufacture and installation of audio communications or, in other words, public address systems. A big break came in winning the tender for the sound system in the Regent Hotel in Fiji. We beat all the big names in the industry, both in price and in design concept. But I began to be interested in electronics retailing.

"Back in those days, the typical electronics shop seemed to be summed up as a painful wait at a long counter only to be eventually informed by often disinterested staff that 'XYZ was out of stock! There had to be a better way and the supermarket format was the answer, to my mind.

The real beginning

"Altronics was actually born on December 6 1976. Our supermarket layout enabled us to attractively display stock, kits and so on and, with self-service the order of the day, the sales staff had plenty of time to answer technical queries, look up transistor equivalents (101 times a day) and generally provide a service to customers that our competitors could not match.

"The secret was that the customers spent 90% of the time serving themselves, leaving us free. Most importantly, we were blessed with bright young enthusiastic staff. While competitors were forever complaining that 'you can't get people to work anymore', we were, and are still today, pestered by keen young enthusiasts busting to work for us.

"Some years back, a survey into customers' experience with retail establishments revealed that the strongest complaint was not what you would expect, like the prices being too high or lousy after sales service. No, the problem was the 'rudeness and discourtesy shown to shoppers by sales staff'. Needless to say, I am very proud of the staff at Altronics and the service they give to our customers. This is the key and whereas many are talking 'gloom, recession and unemployment' Altronics is growing at a rate exceeding 60% per annum!

"Anyway when we opened the shop in 1976, we more or less broke even on the first day. The second day was the same and just as I began to chew my fingernails – bingo – business began to pick up and we were on the road to success. In the years since then, we have served some 200,000 customers and turned over several million dollars in sales. Not that it's been a breeze. It hasn't, of course. We have had to work incredibly hard at times with little to show for it."

"Being based in Perth poses some problems but does give us some amazing advantages. On the negative side though, consider advertising in 'Electronics Australia'. For years we could not bring ourselves to advertise our business in an Australia-wide publication which sold a relatively small portion of its total circulation in WA, as a large portion of our advertising budget would then be wasted. Or so we thought! The

frustrating thing was that a good percentage of our customers are dyed-in-the-wool enthusiasts and are regular readers of EA. On that basis I was always aware that if we were ever to do any effective advertising it would have to be via EA but the cost put me off.

"Finally we took the plunge in January 1981 and tried our first magazine advert in EA. The results were truly gratifying and orders came in from everywhere, including Papua New Guinea and New Zealand.

"Now to the huge advantage of being WA-based. WA exports roughly only one quarter as much to the eastern states as she imports from them. Hence the freight and overnight courier services

Here are two views of the Altronics retail centre while below is a view inside the extensive warehouse.

are all fairly empty on the return journey east. The resultant feight delivery costs from Perth to the other states are unbelievably cheap. For example, it costs us, say, $4 to deliver a parcel from Perth to Sydney or Melbourne whereas the cost to one of our competitors in NSW to deliver the same parcel to Perth could be up to $20."

"Western Standard Time is two hours behind the Eastern States in winter and three hours behind in summer. But that actually gives us an unbeatable advantage.

"For mail order customers we man our phones till 6pm (WA time). Any jet-service order phoned through up till that time is despatched on the 11pm flights which arrive in each State capital city the next morning. Most city couriers then deliver the parcel before the morning is over and the customer receives his or her order all the way from WA. Simple arithmetic tells you that it is virtually impossible for other suppliers to match or beat this service.

"A customer from Canberra rang one morning to say the order he had placed by phone at 7.30pm the night before had just arrived. It was 10.30am. 'My order averaged 130 miles per hour from the time I phoned', he exclaimed.

"I am convinced that our ability to deliver swiftly together with an energetic approach to our business will key factors influencing future growth. We have a good-looking shop and place a strong emphasis on the latest kits and the magazine projects, in addition to a wide range of electronic components. The Altronics wholesale division imports the majority of products we sell. The cost savings are reflected in our competitive prices."

The Future

"As electronics influences everyone's daily lives to a greater degree each year, it is axiomatic that the numbers of electronic enthusiasts will continue to swell. This fact, together with the dynamic nature of the industry, assures a bright future for Altronics as well as (begrudgingly) our competitors."

FORUM

Conducted by Neville Williams

At long last . . .

RECORDING IS OUT OF THE RUT!

In its early days, disc recording was regarded as something of a miracle. Perhaps it's no less of a miracle that a system so basically crude, yet so ingeniously refined, has dominated the domestic recording scene for so long. Only now, in 1983, does it look like giving way to a far superior system — the laser-read digital disc.

The changeover from the old to the new will not be without a certain trauma. As with the demise of the steam train, the passing of the traditional groove and stylus recording system will doubtless be marked by a good deal of lament and nostalgia.

The stereo LP record, as we know it, is the culmination of a century of vision, challenge and endeavour, as well as being the repository of a wealth of recorded sound. One can hardly expect to see it abandoned without some show of emotion.

By contrast, the new laser-read compact disc is the end product of quite recent, intensive research by a relatively small number of back-room boffins.

It has no tradition, no romance of the Edison kind, no continuing challenge for the hifi perfectionist. You simply buy a compact disc player and routinely expect an order of performance to specifications that are quite unattainable with even the most expensive and delicately adjusted conventional phono deck. There the matter ends.

In one sense, instant, off-the-shelf "perfection" may look very impressive in the sales brochures but it is dreadfully final, even somewhat dull for the itchy-fingered buff, who likes to feel that he has had some part in the end result.

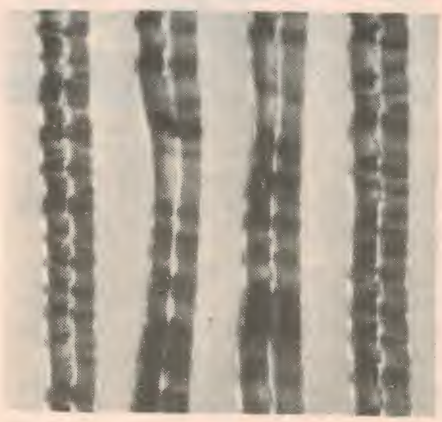
If you don't know what I mean, pay a visit to a live steam railway museum and watch the greying enthusiasts as they move lovingly around their charges, polishing the gauges and dribbling oil from their long-snouted cans on to the drive rods. For all their operational superiority, diesel locos just don't evoke that kind of affection.

For a while, at least, the compact disc and player could also face the problem of acceptance.

My introductory remark about the "miracle" of the early 78rpm phonograph records was meant to be taken seriously.

I can remember as a lad, back in the '20s, the almost universal puzzlement as to how a phonograph did what it did. Technically minded people were no exception. Mechanical things they could understand and repair but, to many of them, the ultimate mystery was how a steel needle, riding the groove in a phonograph record, could recreate the voice of Melba or Caruso!

Mind you, the sound that actually issued from the metal or plywood horn, in those days, was a poor imitation of the original but remember that I am talking about a period when moving pictures were silent and when wireless was something that most people had only read about in the papers. There wasn't a great deal of competition!



(Photograph from the makers of "Parastat" and "Dust-Bug" record cleaners.)

In the middle and late '20s, the phonograph record took a significant forward step with the development of electrical recording and facilities for electrically amplified playback.

I saw these developments at close quarters, firstly in my parents' business, which handled a range of wind-up phonographs, and later as I encountered the first electric pickups at the start of an awakening interest in "electronics" — as it was later called. The pickups were fitted to phonograph tonearms in place of the usual soundbox

At that stage, amplified reproduction through primitive horn or cone loudspeakers was a dubious advantage but quality of reproduction continued to improve through the '30s and '40s culminating, for me, in an involvement with what was claimed at the time to be Australia's most advanced radiogram. Manufactured by Reliance Radio in Barrack St, Sydney, it used the best of everything, including an expensive imported hifi loudspeaker, and a system of automatic volume expansion — a kind of pre-Dolby Dolby.

But no amount of elaboration could overcome the limitations of the old 78rpm format, which remained sacrosanct, jealously preserved by the major record companies. Small, progressive improvement was acceptable, as long as it didn't threaten compatibility with the past! Growing speculation about radically up-graded parameters, finer grooves, etc, belonged "under the carpet", along with another unsettling German development: that of magnetic tape recording.

As I remember it, the late Sir Ernest Fisk, then heading up Britain's EMI, even sought to reassure record dealers throughout the Empire that things would not change on the record scene until his company had decided that the World

was ready for change and had given appropriate notice!

It proved to be a singularly inopportune and futile pronouncement, with the then ruggedly independant Decca company, amongst others, moving first into finer groove 78rpm discs for electrical pickups only, followed by 33rpm long-playing microgroove records.

They signalled the beginning of a substantial revolution in terms of playback quality, largely because the industry had, at long last, burst through the artificial constraints of the mechano-acoustic era. Even so, all the familiar elements still remained – the groove, the stylus, the geometry of groove tracing, the compromises to do with tracking weight, wear, signal amplitude, distortion, system noise, wow and flutter, etc. Essentially what we had was a new set of parameters, but all the old problems!

But, while the microgroove system offered a new plateau in home audio reproduction, it lacked one basic dimension which was emerging as desirable for subjective satisfaction – multi-channel or stereo reproduction.

That followed in the late '50s and, in collaboration with a former Editor, the late John Moyle, we in the magazine were priveleged to present some of the earliest stereo sound demonstrations in this country.

Stereo has, of course, won universal acceptance since then but, essentially, it remains an ingenious elaboration of the monophonic method – yet another variation on the hoary old groove-and-stylus theme.

EVEN QUADRAPHONIC

The same was true of quadraphonic disc recording, which proved a commercial disaster, partly because of wrangling between the various recording companies and partly because hifi fans baulked at having to accommodate four separate loudspeaker systems.

Even so, the research into quadraphonic sound recording and playback was not wasted. It yielded valuable new insight into disc recording and manufacture, stylus and cartridge design and a variety of other issues. It helped push the conventional stereo disc system to its present high stage of refinement. And, let's face it, a modern top quality disc is pretty impressive as a source of recorded sound.

Indeed, as I contemplated this article, I found myself quite seriously asking the question: do home music lovers really need more than they already have: a highly refined phono disc system, supplemented by a highly refined compact cassette system? Both systems can more than satisfy the average listener, and both provide some scope for further exploitation for – and by – the dedicated hifi buff.

Why all the fuss about the laser-digital compact disc? Will it meet a real need or is it primarily a new product to boost a flagging industry?

Demonstrations of the compact disc, turned on for representatives of the media and hifi industry did little to dispel the mood of doubt. Like most such demonstrations, they were social occasions, with lots of hand-shaking, back-slapping and hard sell, plus food, drink and spasms of loud music.

In such surroundings, the subtleties of the sound tend to become buried by the ballyhoo!

What a difference there was when I was able to take a compact disc player home, along with a few discs, hook it up to my own amplifier and simply shut the door, relax, listen and think.

LIGHT DAWNS!

It was then that the implications really hit me. This was not just another record player; another addition to the analog disc family; another climactic moment in 100 years of development. This was technology of a completely new and different kind, which wiped out all the old hassles and problems at one stroke.

Quite spontaneously, I found myself rehearsing a quite different conviction for this article: the phono disc that I/we have known for a lifetime is doomed. For sure, it will continue for as many years as it takes to fossilise but superseded it has been, just as surely as 78rpm and mono recording. It is fated for obsolescence.

There were two reasons for saying this – the first being the unstressed clarity of the sound and a sense that one was listening through a truly "transparent" medium to what was on the master tape. It had behind it the logic that a mass-less beam of light had to be a preferred method to a stylus desperately trying to trace the complex deviations of a physical groove.

The other was the performance specification – of necessity, in these days of consumerism, a credible statement. These are covered elsewhere in the issue.

Nor is it a matter of improved performance won, at considerable cost, by further extremes of quality control. The fact is that many of the problems inherent in phono disc players do not arise in the laser-digital compact disc system.

There is no scope for wow or flutter, no rumble, no speed regulation problem, no acoustic feedback. There are no tracking or resonance problems with the tonearm, no delicate compromises involving tracking weight and cartridge behaviour, no hypercritical stylus and cartridge dynamics, no stylus wear and no disc wear.

I am not suggesting that the compact

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Rugged design – will last for years!

Will mount on vertical mast up to 38mm dia.

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Wide operating frequency range: 65MHz-520MHz

No special mounting needed – will stand alone for use on roof or patio.

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Cat B-9600

$12.95

DICK SMITH Electronics

SEE PAGE 98 FOR ADDRESS DETAILS

DSE/A413/LM

disc and player will be trouble-free. It contains new and critical technology and will inevitably bring with it a whole new set of mechanical and electronic bugs. But they will be bugs of the go/no-go type; once they are corrected, the player will tend to revert to specifications.

In a curious way, the descriptions "analog" and "digital" apply not only to signal processing in the traditional phono and compact disc; it applies also to the operation of the respective decks!

One final point should be made, however: the coming of the compact disc will not mean an automatic feast of "perfect" recorded sound.

What comes off the disc can only be as good as the source. Things that go amiss in the performance, in the acoustics, in the mic placement, in the panel work and the mastering will be heard more clearly than ever. What's more, I guess that a lot of existing music will be transferred to CD, because it is music that listeners want to hear.

The vital point is that, good, bad or indifferent, the source sound will not suffer significant further degradation on its way from the master recording to the input terminals of your hifi system. And that's nice to know!

Did I say earlier that off-the-shelf "perfection" might be somewhat dull for the itchy-fingered hifi buff?

On second thoughts, it might be quite a relief to be able to eliminate the player and even the discs themselves as a source of uncertainty in a domestic hifi system.

It might provide one with more time and incentive to agonise about the loudspeakers!

See no evil, hear no evil . . .

While it is easy to be enthusiastic about the performance specifications of the Compact Disc, some hifi buffs express objection to the whole principle of digital encoding and decoding. They maintain that it produces a subjective degradation in quality which, presumably, does not show up in electrical measurements.

Curiously, recording engineers, who might be expected to be acutely aware of any such shortcoming, do not appear, as a group, to share these misgivings. I specifically asked the Sony people, here to demonstrate the compact disc, about the basic validity of the system. It seemed that, as far as they were concerned, the specifications told it all.

I was also interested to read, in a recent issue of "Gramophone" magazine, a detailed account of an audience reaction test of a digital processing system, involving 50 hifi dealers at a conference in England. Because of the highly contentious nature of the subject, every effort was made to achieve completely "blind" test conditions, with literally no one in a position to influence the responses.

A top quality amplifier system was set up and the subjects were free to select their own discs, the turntable on which they were to be played, and the listening level. The only departure from normal was that the system contained a loop which could divert the signal through a Sony PCM-F1 digital encoder and decoder via a silent switching system, and with the relative gains balanced to within 0.05dB.

The subject was given a small control box with a button affecting the changeover switch and two other buttons marked "A" and "D" (Analog and Digital). The first button did not operate the changeover switch directly but sent a cue to a Hewlett-Packard HP85 computer. By reference to a random number system, the computer then decided which channel to select; in effect, no one in the room knew which channel was operating at any time or whether a changeover had indeed occurred.

However, the information was stored in the computer and subsequently compared with the subject's responses via the A and D buttons. The questions to which the computer had to seek an answer were: (1) Can the subject detect a difference between the two sounds and (2) Can he/she label it in terms of analog and digital?

Statistical procedures had to be applied to the data to minimise the effect of chance and to isolate the apparently significant scores for further analysis and possible re-resting. Without going into all the details, the end result was interesting, to say the least. Of the 43 individuals tested, only five returned "probably significant" scores, indicating that they could probably hear a difference between the two paths. But four of the five returned insignificant scores when they were re-tested.

In the end, out of 60 tests involving 43 people, only one confirmed a score which indicated that he could probably hear a difference between the channels. However, his "A" and "D" verdicts were completely reversed in his two sets of results, indicating that, if he could tell the difference, he was unsure which was which!

WALL CHART

These two pages are invaluable for the Kit Builder and School Master. Printed circuit pricing and month of magazine coming out are included as well as name of kit and project. It not only helps us at Rod Irving Electronics to find the month and number of a kit, but also shows the incredible range we have available. Others say they are No. 1 for kits but we get on with the job, the range below proves it. Please note some of the older projects are in limited supply and might take longer to deliver. The challenge of building a kit as well as the knowledge gained from it, is invaluable, I would say that practical practice in electronics is the true key to successful understanding:-
May we all strive a bit harder for 1983 to make Australia a better country.

Rod Irving

REVISED 17th DECEMBER 82

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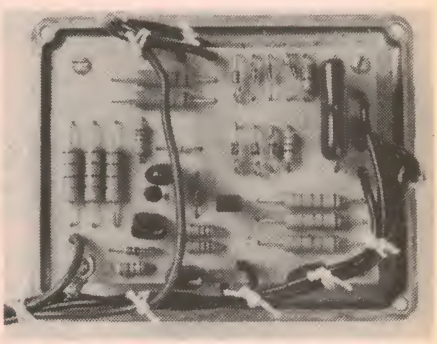
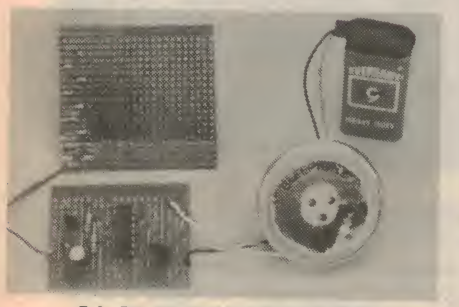
ET 328	2.90	LED OIL TEMP METER	JAN81	19.00
ET 329	2.50	EXP. SCALE VEHICLE AMMETER	FEB81	19.00
ET 330	3.90	CAR ALARM	JUL81	29.00
ET 332	3.90	ELECTRONIC STETHOSCOPE	AUG81	34.00
ET 333	3.90	REVERSING ALARM	JAN82	10.00
ET 334		AUTO TESTER	JAN83	
ET 363	3.50			
ET 417	2.90	OVERLOAD INDICATOR	AUG73	
ET 438	3.90	LED LEVEL METER		12.95
ET 440	8.50	25 WATT STEREO AMP	MAR75	
ET 445	2.90	GENERAL PURPOSE PREAMP	JUL76	8.25
ET 446	3.90	STEREO LIMITER	JUL76	
ET 449	2.90	MIKE PREAMP	MAY77	
ET 450A	3.90	BUCKET BRIGADE	DEC77	
ET 450B	3.90	BUCKET BRIGADE	DEC77	
ET 452		GUITAR PRACTICE AMPLIFIER	JAN80	
ET 453	2.90	AMP CLASS B GEN PURPOSE	APR80	
ET 454	3.90	FUZZ BOX	APR80	
ET 455	4.50	LOUD SPEAKER PROTECTOR	MAR80	32.50
ET 457	2.90	SCRATCH & RUMBLE FILTER	SEP80	
ET 458	4.90	LED LEVEL METER	JUN81	27.00
ET 459A	16.50	SERIES 5000 1/3 OCT GRAPH EQU	NOV82	189.00
ET 459B	16.50			
ET 461	3.90	BALANCED INPUT PREAMP	DEC82	20.00
ET 466	8.50	300W AMP MODULE	FEB80	63.00
ET 467	6.90	4 INPUT MIKE PREAMP	JUL80	27.50
ET 470	3.50	60 WATT AMP MODULE SERIES 4000	TPV6	26.00
ET 471	9.90	AUDIO PREAMP SERIES 4000	TPV6	49.50
		SERIES 4000 FRONT PANEL		14.90
ET 472	3.90	POWER SUPPLY FOR SERIES 4000	TPV6	24.00
ET 473	5.90	MOVING COIL PREAMP SERIES 4000	TPV6	54.00
ET 474	2.90	INTERFACE 60W AMP	JAN80	
ET 475	5.90	AM TUNER	SEP80	99.00
ET 476	7.90	SERIES 3000 AMP 25W STEREO	NOV80	84.00
ET 477	4.90	SERIES 5000 PWR. AMP MOD 150W	JAN81	58.50
		SERIES 5000 POWER AMP COMPLETE KIT		299.00
ET 478MB	13.90	SERIES 5000 PREAMP MAIN BOARD	OCT81	
ET 478MC	4.90	MOVING COIL PREAMP (5000)	SEP81	24.50
ET 478MM	4.90	MOVING MAGNET PREAMP (5000)	SEP81	18.50
ET 478SA	2.90	SERIES 5000 PREAMP SWITCH BRD	OCT81	
ET 478SB	1.90	SERIES 5000 PREAMP SWITCH BRD	OCT81	
ET 478SC	1.90	SERIES 5000 PREAMP SWITCH BRD	OCT81	
ET 478SD	1.90	SERIES 5000 PREAMP SWITCH BRD	OCT81	
ET 479	3.50	SERIES 5000 BRIDGING ADAPTOR	MAR82	12.90
		SERIES 5000 PREAMP COMPLETE KIT		259.00
ET 480	3.90	50 WATT AMP MODULE	30AP	17.50
ET 480	3.90	100 WATT AMP MODULE	30AP	22.00
ET 480PS	2.90	50-100W AMP MODULE PWR SUPPLY	30AP	22.50
ET 481M	3.95	HI-POWER P.A/GUITTAR AMP MOD.	30AP	
ET 481PS	4.90	12V/100 P.A INVERTER	30AP	
ET 483	4.50	SOUND LEVEL METER	FEB78	
ET 484	5.90	EXPANDER COMPRESSOR 30 A.P	JUL77	
ET 485	5.25	GRAPHIC EQUALISER	JUN77	
ET 486	4.90	HOWL ROUND STABILIZER	NOV77	59.00
ET 488	7.90	60W AMP MODULE	JAN83	
ET 489A	3.50	AUDIO SPECTRUM ANALYSER NO2	APR78	
ET 489B	3.50	AUDIO SPECTRUM ANALYSER NO2	APR78	
ET 492	3.90	SOUND BENDER	FEB82	29.00
ET 494	3.90	LOUD SPEAKER PROTECTOR	OCT82	24.50
ET 496		SERIES 4000-1 SPEAKER KIT	FEB80	699.00
		SPEAKERS & CROSSOVERS		479.00
		CROSSOVER KITS		199.00
		SPEAKER BOXES		259.00
ET 499	4.95	50W MOSFET AMP 75 85	MAR82	79.00
		TRANSFORMER		43.50
		ANODISED HEATSINK		42.50
ET 525				
ET 528	2.90	INTRUDER ALARM	JAN75	
ET 539	3.90	TOUCH SWITCH	MAR76	
ET 541	3.90	TRAIN CONTROLLER	MAY76	
ET 547	3.50	TELEPHONE BELL EXTENSION	JUN77	
ET 549A	3.90	METAL DETECTOR	MAY77	
ET 560	2.50	240V MAINS LOCATOR	MAY80	
ET 561	3.90	METAL DETECTOR	MAR80	34.00
ET 562	3.90	GEIGER COUNTER	APR80	
ET 563	4.50	NICAD FAST CHARGER	JUL80	54.90
ET 566A	2.90	PIPE & CABLE LOCATOR	APR80	
ET 566B	4.90	PIPE & CABLE LOCATOR	APR80	
ET 567	4.50	CORE BALANCE RELAY	APR81	44.50
ET 568	2.90	PHOTO FLASH TRIGGER	OCT80	26.50
ET 570A	2.90	INFRARED 'TRIP' RELAY TX	JAN82	24.50
ET 570B	3.20	INFRARED 'TRIP' RELAY RX	JAN82	
ET 572	4.90	DIGITAL PH METER WITH PROBE	DEC80	109.00
ET 573	4.50	UNIVERSAL TIMER	OCT79	
ET 576	8.90	ELECTROMYOGRAM	TPV6	89.00
ET 577	3.50	GENERAL PURPOSE POWER SUPPLY	TPV6	39.50
ET 578	3.90	SIMPLE NICAD CHARGER	JUN80	
ET 581	3.25	15V DUAL POWER SUPPLY	JUN76	17.50
ET 583	2.90	MARINE GAS ALARM	AUG77	
ET 585R	2.90	ULTRASONIC RECEIVER	TPV6	17.95
ET 585T	2.90	ULTRASONIC TRANSMITTER	TPV6	10.95
ET 591A		UP/DOWN DIGIT COUNTER	JUL78	
ET 591B				
ET 596	2.90	WHITE NOISE GENERATOR	NOV81	8.00
ET 598		TOUCH SWITCH	FEB81	10.00
ET 598B	2.50	TOUCH SWITCH	FEB81	
ET 599A	2.50	INFRA RED REMOTE CONTROL	MAY80	76.00
ET 599B	2.50			
ET 599C	2.90			
ET 599D	2.20	I.R REMOTE CNTRL POWER SUPPLY	MAY80	
ET 603	4.90	MUSIC SYNTHESIZER SEQUENCER	AUG77	
ET 604	4.50	METRONOME	SEP77	
ET 606	3.90	ELECTRONIC TUNING FORK	NOV79	
ET 607A	2.90	SOUND EFFECTS GENERATOR	AUG81	12.50
ET 607nl	2.90	SOUND EFFECTS GENERATOR	AUG81	
ET 631-2	7.50	KEYBOARD ENCODER	APR77	
ET 635	4.90	COMPUTER POWER SUPPLY	APR81	



E.A. Feb 83 Transistor-assisted Ignition $35.00

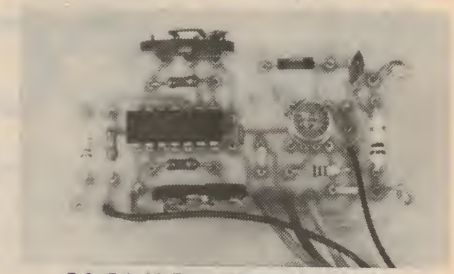
ET 636	18.90	7 SLOTT S100 MOTHER BOARD	MAY80	85.00
ET 638A	5.90	EPROM PROGRAMMER	JUL78	
ET 640	69.00	MEMORY MAPPED VDU		129.00
ET 644	52.50	DIRECT CONNECT MODEM	OCT82	169.00
ET 645		TURTLE ROBOT	MAY82	
ET 647		SPEECH SYNTHESISER	OCT82	
ET 650A	4.90	STAC TIMER	NOV78	
ET 650B	4.50	STAC TIMER	NOV78	
ET 650C	4.50	STAC TIMER	NOV78	
ET 653	6.50	16 CHANNEL COMP OUTPUT DRIVER	NOV82	45.00
ET 660	19.00	LEARNERS MICROCOMPUTER	ICT81	99.00
		KEY SET (18) TO SUIT ET660		30.00
		COLOUR OPTION KIT TO SUIT 660		14.50

ET 670	11.00	LOW COST MICRO KEYBOARD	MAY82	
ET 682	79.00	VERSATILE EPROM CARD	MAR81	115.00
ET 686	9.50	PPI-BASED EPROM PROGRAMMER	OCT82	48.00
ET 708	2.90	AERIAL AMP	MAR76	
ET 713	4.90	FM TUNER ADD ON	SEP77	
ET 717	4.50	CROSSHATCH GENERATOR	MAY78	
ET 726	3.50	R.F AMP 70W 6/10 METER	FEB80	
ET 729		UHF TV MASTHEAD AMP	APR81	36.00
ET 730		UHF TV CONVERTER	MAY81	37.50
ET 731	4.50	TELETYPE MODULATOR	OCT79	
ET 735	4.90	UHF TO VHF CONVERTOR	MAY81	
ET 760	2.50	VIDEO MOD. TO SUIT 660 MICRO	OCT81	14.50
ET 824	2.90	SLOT CAR POWER SUPPLY	DEC81	19.50
ET 825	5.90	SLOT CAR CONTR. (NO CASE)	DEC81	59.00
ET 905	16.00	POLYPHONIC ORGAN	JAN83	
ET 1501A	2.90	NEGATIVE ION GENERATOR	APR81	39.00
ET 1501B	2.90	NEGATIVE ION GENERATOR	APR81	
ET 1501C	2.00	NEGATIVE ION GENERATOR	APR81	
ET 1503	3.90	BATTERY CHARGER	AUG81	
ET 1508		MODEL TRAIN CONTROLLER SINGLE DOUBLE	DEC82	115.00
ET 1509		D.C.-D.C. INVERTER	SEP82	39.50
ET 1510A		MODEL RAILWAY POINTS	JAN83	



E.A. Feb 83 Moisture Alarm $12.00

ET 1510B		CONTROLLER AND INDICATORS		
EA 6800	14.50	6800 MICRO COMPUTER		115.00
EA 6802	14.50	6802 MICRO COMPUTER		115.00
		POWER SUPPLY TO SUIT		35.00
		HEX KEYPAD 19 KEYS		35.00
75CD7	3.50			
75L11	2.50			
78C5	4.90			
78A06	3.90			
78N6	3.90			
78T3	4.50	PHOTO TIMER	MAR78	
78NG4	2.90	PINK/WHITE NOISE GEN.	APR78	
78UT4	4.50	LOW COST VDU KEYBOARD	APR78	
78UP10	9.50	2650 EXTRA RAM	OCT78	
79SB10	3.90	BASS FILTER	OCT79	
79FE11	2.50	PHOTO FLASH EXPOSURE MTR.	NOV79	24.50
79PC9	3.90	PULSE GENERATOR	SEP79	
79SE3	3.90	TRAIN MODEL SOUND	MAR79	
79TI11	2.90	TRANSISTOR ASSISTED IGN.	NOV79	32.50
79PS11	2.90	EXPERIMENTORS POWER SUP.	NOV79	
79PC12	2.90	FAN SPEED CONTROL	DEC79	
79SF10	2.50	PHOTO SLAVE FLASH	OCT79	
79SF9	2.90	PHOTO SOUND TRIGGER	SEP79	
79UPS6	3.50	UNIVERSAL POWER SUPPLY	JUN79	29.50
80ST10A	3.50	STYLUS TIMER	OCT80	
80ST10B	2.50	STYLUS TIMER	OCT80	
80TC12	2.90	BIPOLAR TRAIN CONTROLLER	DEC80	28.00
80CM3A	4.50	DIGITAL CAPACITANCE MTR.	MAR80	45.00
80CM3B	2.50		MAR80	
80PG6	6.50	T.V. PATTERN GENERATOR	JUN80	59.50
80TV8	3.90	T.V. CRO ADAPTER INC. P/PACK	AUG80	38.50
80F3	3.20	AUDIO PRESCALER	MAR80	
80PP3	2.50		MAR80	
80LL7	3.90	LEDS & LADDERS	JUL80	19.50
80B7	2.50	BEAT FREQUENCY OSCILLATOR	JUL80	
80BM10	2.90	CAR BATTERY MONITOR	OCT80	9.50
80SA10	9.90	STEREO AMP. MOSFET	JAN81	169.00
80DC10	6.50	DIGITAL STORAGE CRO AD.	NOV80	78.00
80GA12	6.50	GUITAR AMPLIFIER	DEC80	
80HLA5	2.90	CAR HEADLIGHT ALARM	MAY80	
80LS12	3.50	SELECTALOTT	DEC80	22.00
80LBR12	2.90	LIGHT BEAM RELAY	NOV80	13.00
80PC4	2.90	POWER HEAT CONTROLLER	APR80	
80PC7	3.50	POWER SAVER INDUCTION MTR	JUL80	
80FB12	2.90	GUITAR FUZZ BOX	FEB81	19.90
80G6	5.90	MUSICAL TONE GENERATOR	JUN80	
80GPS3	2.90	VOLTAGE REGULATOR MULTI	MAR80	
80AD12	3.00	AUTODIM LIGHT DIMMER	DEC80	
80AU3	3.50	HI FI AUTO TURN OFF	MAR80	
80AW4	4.50	RECEIVER ALL WAVE	APR80	
80TM8A	6.90	DIGITAL ENGINE ANALYSER	AUG80	48.50
80TM8B	2.90		AUG80	
80PP7A	8.50	EPROM PROGRAMMER	JUL80	77.50
80PP7B	2.90	EPROM PROGRAMMER	JUL80	
80RF5	2.90	RUMBLE FILTER	MAY80	
8RM12	3.90	CYLON VOICE SIMULATOR	DEC80	19.95
80SA3	5.90	PLAYMASTER STEREO AMP.	MAR80	
80CH7	8.50	240V A.C. LIGHT CHASER	JUL80	
80RM12	3.90	RAM EXPANSION FOR DREAM	DEC80	39.00
80PA6	7.50	PLAYMASTER 300W AMP. MODULE	JUN80	63.00
80CL4	3.50	TIMER CONTROLLER	APR80	
80TRS11	2.90	TRS 80 PRINTER SERIAL IN	NOV80	15.00
81DC2	2.90	LE GONG DOORBELL	FEB80	14.95
81DT5	3.00	DREAM TAPE CONTROLLER	MAY81	
81GA3	11.50	COLOUR GRAPHIC ANALYSER	MAR81	109.00
81UC8	4.50	UNIVERSAL TIMER & STOPWATCH	AUG81	
81MP6	3.90	MICROPROCESSOR POWER SUPPLY	JUN81	
81IR4A	4.50	INFRA-RED RELAY	APR81	39.00
81IR4B	2.90	INFRA-RED RELAY	APR81	
81SP1	2.90	RS232 TRS80 SYSTEM 80 INTFCE	JAN81	
81SI3	7.90	TRS80/SYSTEM 80 SERIAL INTFCE	MAR81	
81SW	3.90			
81MC7	2.90	MOVING COIL PREAMP	JUL81	
81RM2	2.50		FEB81	
81DC3B	8.50	DIGITAL AND	NOV80	189.00
81DC3A	9.50	ANALOGUE STORAGE CRO	MAR81	
81WS10	3.90	WIND SPEED INDICATOR	OCT81	52.50
81P6	2.90	POOL/LOTTO SELECTOR	JUN81	22.50
81A010	3.50	AUDIO TEST UNIT CASS. DECK	OCT81	47.50
81MC8	10.90	MUSICOLOUR IV	AUG81	84.00
81SG9	4.20	LED SANDGLASS	SEP81	22.50
81CI9		DIGITAL CLOCK THERMOMETER	SEP81	80.00
81SS11	6.90	SLIDE CROSS FADER	NOV81	89.50
81GA9	4.90	PHOTON TORPEDO GAME	SEP81	24.50
81UC8	4.90	UNIVERSAL TIMER	AUG81	
8MC7	9.50	MOVING COIL PREAMP	JUL81	
8SW7	4.90	TRAIN STEAM WHISTLE	JUL81	17.50
81SM7	3.90	BAGATELLE	JUL81	
81VM2	2.90	HIGH IMPEDANCE DC VOLTMTR	FEB81	
81CC5	2.90	PC BIRDIES	MAY81	14.50
81HB4A	7.50	HEART RATE MONITOR	APR81	79.00
81HB4B	3.50	HEART RATE MONITOR	APR81	
81A06	4.90	AUDIO OSCILLATOR	JUN81	59.00
81MA4	4.50	TOUCH SENSITIVE ALARM	APR81	
81RC4A	4.90	INFRA RED REMOTE CONTROL	APR81	72.00
81RC4B	2.50	INFRA RED REMOTE CONTROL	APR81	
81RC4C	2.75	INFRA RED REMOTE CONTROL	APR81	
81SP5	2.90	SOUND PRESSURE METER	MAY81	37.00
810R7	9.50	ELELECTRONIC ORGAN	JUL81	59.00
81CH12	3.50	CHRISTMAS DECORATION	DEC81	15.00
81fm10A	4.90	500MHZ DIGITAL FREQ. MTR.	DEC81	135.00
81fm10B	3.50	500MHZ DIGITAL FREQ. MTR.	DEC81	
811d12	4.50	LED BAR GRAPH DISPLAY	DEC81	
81mi11	2.90	METRONOME (LOW CURRENT)	JAN82	16.90
81wd12A	3.50	WIND DIRECTION INDICATOR	JAN82	24.50
81wd12B	3.50			
82EP1	12.50	FREE STANDING EPROM PROGRAMMER	JAN82	45.00
		WITH '24 PIN' TEXTOOL SOCKET AND AC PLUGPACK		55.00 69.50
82TH2	3.90	DIGITAL THERMOMETER	FEB82	69.00
82CR1	13.50	LGE. SCRN. STORAGE CRO ADAPTER	FEB82	119.00
82EG2	2.90	CUDLIP	FEB82	12.00
82PS2	4.90	DUAL TRACKING POWER SUPPLY	MAR82	83.50
82LF2	3.90	LOW FUEL INDICATOR	MAR82	16.50
82CM3	3.50	LCD CAPACITANCE METER	MAR82	69.00
82A03A	7.90	FUNCTION GENERATOR	APR82	79.50
82A03B	3.90		APR82	
82VC3	3.50	VOICE CANCELLER	APR82	22.50
82VX4	3.50	VOX	APR82	15.00
82PT4	3.90	PHOTOGRAPHIC TIMER		48.00
82IV5	5.40	12-240V INVERTER 40 WATT	MAY82	49.50
82P5	5.90	UNIVERSAL PREAMP MM/MC	MAY82	35.00
82T05	3.90	TACHO/DWELL METER	MAY82	62.00
82TS3	3.90	LOW COST TOUCH SWITCH	MAY82	12.00
82GA3	9.90	GUITAR BOOSTER	JUN82	17.50
82EM6A	4.90	THEREMIN	JUN82	34.50
82IV6	6.90	12-240V INVERTER 300 WATT POWER MONITOR	JUN82 JUL82	189.00 18.00
82HB6	3.90	LCD HEART RATE MONITOR	JUL82	
82CC7A	15.50	CAR COMPUTER	JUL82	109.00
82CC7B	4.00	CAR COMPUTER	TO SEP82	
82DP6	4.90	DECIMAL POINT FOR D.F. METER	JUL82	70.00
82PA7	9.50	SUB WOOFER AMP	JUL82	85.00
82UR8	3.90	ULTRASONIC RULE	AUG82	49.00
82MS8	6.50	STEREO SYNTHESISER	SEP82	55.00
82EF9	4.90	ELECTRIC FENCE	SEP82	19.50
82PC8	2.00	FLOURESCENT STARTER	OCT82	5.00
82FC8A	6.50	DIGITAL READOUT	OCT82	72.00
82FC8B	3.90	FOR SHORT WAVE		
82FC8C	2.50	RECIEVERS		
82TA10	3.90	FREEZER ALARM	OCT82	21.00
82VS10		SPEECH SYNTHESISER	OCT82	
82PC10	3.90	POWER UP	NOV82	33.00
82AL11	3.90	SUPER SIREN		21.00
82PC11	3.90	DRIVEWAY SENTRY	DEC82	32.00
820R12A		PLAYMASTER AM TUNER	DEC82	239.00
820R12B				
82PH12	2.90	DIGITAL PH METER	DEC82	115.00
82EG12	2.90	BOGGLE GOGGLES (SHORT FORM)	DEC82	9.60
83TV1A	4.90	REMOTE INFRARED TV	JAN83	39.50
83TV1B	2.90	SOUND CONTROL	JAN83	
83TV1C	2.90		JAN83	
83PS1	2.90	PLUGPACK REGULATOR	JAN83	12.00
		WITH PLUGPACK		26.50
83EG1	3.50	LED HEAD LIGHT CHASER	JAN83	12.00
HOBBY ELECTRONICS				
HE102	3.50	GUITAR PHASER	JUN81	25.00
HE103		TRANSISTOR TESTER		9.40
HE104	2.90	A.M. TUNER	MAY81	7.50
HE105	2.90	BASIC AMPLIFIER	MAY81	9.50
HE106	2.90	F.M. RADIO MICROPHONE	MAY81	8.50



E.A. Feb 83 Tuner Alignment Kit $8.00

HE107	3.90	ELECTRONIC DICE	JUN81	5.95
HE108	2.90	POWER SUPPLY		11.95
HE110		UNMISTAKABELL		6.90
HE111		OHMETER		19.90
HE112	2.20	MICROMIXER		11.90
HE113	2.50	WATER ALARM		9.45
HE114	3.50	DIGITAL COUNTER	OCT81	14.50
HE115	2.50	REACTION TIMER		
HE117		HOUSE AND CAR ALARM		16.90
HE121	2.50	SCRATCH AND HISS FILTER		9.00
HE123	3.90	ALIEN INVADERS		
HE126	2.50	NICAD CHARGER (P/PACK EX $9.95)		
HE127		SIREN		3.90
HE128		FOG HORN		
HE129	2.50	SIMPLE TUNER		
DIGITAL RESEARCH S100 & SS50 BOARDS				
S100		16K RAM BOARD		$69.00
S100		32K EPROM BOARD		$69.00
S100		64K RAM BOARD		$110.00
SS50		16K RAM BOARD		$69.00
SS50		64K RAM BOARD		$110.00

As demonstrated recently in Australia, Sony's model CDP-101 compact disc player. Currently, about 20 manufacturers are offering CD players on the Japanese domestic market.

Ready for immediate release:

The COMPACT DISC

1983 has already been accorded the title "The year of the compact disc". For those who have not caught up with this important new development in audio-hifi, this deliberately basic article should put you into the picture and prepare the way for further detailed discussion of compact discs and compact disc (CD) players.

by NEVILLE WILLIAMS

For something like 100 years, domestic phonographs or gramophones have depended on audio signals preserved as a "wiggly" groove inscribed in the surface of a rotating cylinder or a spinning disc.

For replay, the groove is traced by a "needle" or stylus which, in the days of the acoustic phonograph, transferred the tiny deviations in the groove to a flexible diaphragm at the small end of an acoustic horn. Since the early '30s, however, the preferred method has been to use a stylus in a phono "pickup" which generates an electrical signal suitable for feeding into an audio amplifier system.

By way of illustration, imagine that one brief segment of a sound reaching the studio microphone produces a pressure wave as in Fig. 1a. As recorded in the groove of a normal monophonic disc record, that same segment of sound could be expected to produce a groove deviation of recognisably similar shape (Fig. 1b). Later, when sensed by a pickup — or phono cartridge — an equivalent electrical signal would be produced (Fig. 1c).

Looking at the three curves, one might well observe that the groove resembles a continuous graphical plot of the original sound pressure wave and that, when replayed by a phono cartridge, it produces a continous electrical signal of equivalent contour.

These days, in technical discussion, we tend not to use the word "continuous" to describe a waveform, referring to it instead as an "analog" waveform.

The term has been inherited largely from computer technology, where a minority of computing systems, which sense and react to quantities in a continuous way, are described as analog computers. It distinguishes them from all the rest, which receive and process data as a stream of samples or units. These are described as digital computers.

As we shall see later, the word "digital" has also entered hifi jargon and is very pertinent to the subject we are leading up to. But more of that later.

All phono discs to date are basically analog, because they use a continuous groove whose contours are physically related to the contours of the original sound wave. (To use a more familiar word from the same root, the curves could be described as analogous.)

All normal open-reel and cassette tape recorders are analog in principle,

because there is a direct and continuous equivalance — or analogy — between the original sound pressure wave and the intensity of the magnetic pattern on the tape.

In fact, until quite recently, every aspect of sound recording and reproduction was analog, because it seemed to be the obvious way to do things and the only way that was practical, anyway, with available technology!

Just in passing, someone might object that Fig. 1 is an over-simplification; that stereo grooves are more complex than those illustrated; further, that the use of recording and playback frequency compensation affects waveshapes. Both observations are true but the point we want to draw is more easily seen from the simple case — and it holds for all the rest!

In an ideal record/replay system, the recovered signal should be exactly equivalent to — or a precise analog of — that delivered by the recording microphone(s). Unfortunately, the ideal is easy to state but virtually impossible to attain with a conventional disc recording system.

PRACTICAL PROBLEMS

If the recording amplifier and groove cutting stylus system do not respond precisely and proportionately to the drive signal, the contours of the groove will be slightly misshapen.

Similarly if, for any reason, the replay stylus does not follow the same relative path as the cutting stylus, a further lack of equivalence will be evident between the recovered and original signal.

It transpires that incorrect contours in the original groove, and a deviation by the playback stylus from its true path, generate additional and spurious frequencies which are usually multiples of the actual signal frequency. The phenomenon is therefore described as "harmonic distortion" and is something that needs to be minimised, not only in disc records but in all aspects of sound amplification.

Special instruments and procedures are used to measure harmonic distortion and the performance of items of audio equipment in this respect is commonly expressed by summing all the harmonics present and quoting a figure for total harmonic distortion. Commonly, this is reduced to the initials "THD" and is expressed as a percentage — the smaller the better!

As you may have gathered from those last two paragraphs, the generation of harmonic distortion is a potential problem right through an amplifier chain, but it is particularly troublesome in an analog disc system and, for that matter, in an analog tape system as well!

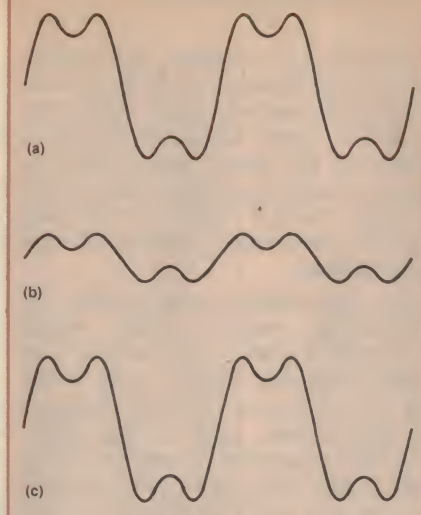


Fig. 1: A sound pressure wave (a), a groove pattern, as recorded (b), and a resultant electrical signal (c). All three waveforms are analog.

Unfortunately, the analog disc system suffers from quite a few other problems and these could be summarised as follows:

TRACING DISTORTION: Occurs when, for any reason, the stylus vibrates within the groove, instead of following its precise contours. It produces a buzzing effect, commonly described as an unpleasant "edge" on orchestral strings, massed voices, etc.

NON-LINEAR FREQUENCY RESPONSE: Results from resonance effects involving the arm and/or cartridge, reactive effects in the wiring and associated circuitry, groove tracing problems, etc. Frequency response should ideally be flat over the full audible bandwidth but is normally expresed as: within or "±" so many dB — the smaller the figure, the better!

SURFACE NOISE: Results from anomalous movement of the stylus caused by foreign particles in the groove, surface scratches, roughness of the groove walls and the texture of the record material itself. Spurious impulses resulting from any of these causes are inseparable from the wanted signal and are amplified along with it.

LIMITED DYNAMIC RANGE: The ratio between the loudest peaks in a musical or other program and the softest passages is referred to as the "dynamic range" and is expressed in decibels. Existing analog records have difficulty in accommodating the dynamic range of some program material, because the loudest passages may produce an overload condition — a sharp rise in THD — while the softest pasages are masked by the system noise.

LIMITED SIGNAL/NOISE RATIO expresses much the same relationship in a slightly different manner: the ratio in decibels between the largest signal that a record/replay system will handle, without severe distortion, and the inherent system noise level.

WOW & FLUTTER: A wavering quality imparted to the recorded sound when the rotational speed of the turntable is not completely constant. Discs which are slightly off-centre or are warped can also add significant wow to the sound reproduction.

RUMBLE: An annoying low frequency hum (or rumble) which results when vibration from a "noisy" or rough-running turntable drive mechanism or support bearing reaches the stylus and cartridge and produces a spurious low frequency signal. Uneven flow and cooling of the hot vinyl during pressing of phono discs also leads to what is known as "pressing rumble" and this is often worse than the rumble due to typical turntables.

MICROPHONICS, sometimes referred to as acoustic feedback. When acoustic energy from the loudspeakers produces vibration of the turntable or the arm and cartridge, it can exaggerate certain low frequencies, producing a drumming effect or even a sustained roar when the volume control is advanced.

RECORD WEAR, FOULING: Present-day records do wear gradually with repeat playing, can be damaged by worn styli and careless handling, and can be rendered noisy by foreign particles in the grooves.

ANOTHER APPROACH?

A recital of such potential problems makes the analog disc record system sound very unattractive and, indeed, up till the end of the 78rpm era, it provided plenty to complain about. However, over the last 30-odd years, analog disc technology has made enormous advances, to the point where the best discs played on the best equipment are very good indeed.

But the best equipment is expensive — in extreme cases, ludicrously so. Only a limited number of records are of top quality, and care is needed to keep them in pristine condition, free from dust, unmarked and unworn.

At the heart of the problem is the fact that the analog disc system, by its

THE COMPACT DISC — continued

nature, is inherently prone to all these problems and the job of winning small further improvements in performance is running up against the law of diminishing returns.

We have just about reached the end of the line!

Is it not possible, then, to envisage a whole new approach which will, at one stroke, diminish or even banish some or all of these problems?

THE ALTERNATIVE

The answer is "yes" and the alternative approach is described by that other word inherited from computer lore: "digital". We'll explain the term in detail later but, in the meantime, let's continue on with the main theme.

Well aware of the rapid developments in digital technology, audio engineers began to realise that it might offer a way around the intransigence of the analog system but they could foresee one major deterrent: the digital method would require a domestic-level record/replay medium having a frequency response far wider than any analog system — running into megahertz rather than kilohertz!

In fact, just such a facility turned up a fedw years ago in the form of a home video cassette recorder. Even more interestingly, the VCR was followed by video discs which were designed and priced for home use, with a playing time of about an hour, and carrying signal frequencies into the megahertz range.

Manufacturers realised immediately that they had the basis for a high performance, multi-channel digital audio disc but, at the outset, they were far too interested in the home video market to worry too much about audio. Only when the video market faltered, did they begin to look more urgently to the audio/hifi field.

Their first offering was actually an analog/digital adaptor which would allow audio signals to be recorded on existing domestic VCRs — VHS in the case of one group of manufacturers, and Beta in the case of the other. These were followed by self-contained stereo audio recorders using, respectively, VHS or Beta cassettes and offering recording times of either 240 or 215 minutes.

WHAT TO RECORD?

These equipments are readily available but are used mainly for small studio mastering work. There is little point to their use in domestic situations, because private recordists seldom have access to material to match their very advanced performance specifications.

In the area of video-based audio discs, it looked very much for a while as if consumers might be faced with the unwelcome choice of three different formats. Early thinking was that it would be logical to make the new high-performance digital audio discs compatible with the video format, so that the same player could be used for both. This could have meant audio discs based on the CED format developed by RCA, the VHD format (JVC-Matsushita) and the LV format (Philips, Sony).

Fortunately, Philips and Sony took a different view, based on the wise assumption that the hifi industry could not afford a repeat of the quadraphonic debacle. They suggested that any new style audio disc should be of small rather than large diameter — for example 12cm instead of 12in. This would encourage the production of compact playing decks and may even permit the use of such records in cars.

The new record, they maintained, should use their laser principle to eliminate the problem of record wear and also to substantially obviate problems with finger marks, surface scratches and dust. It should — and could — have a flat frequency response, very little distortion, very low noise level and high dynamic ratio, no stylus tracking problems, no wow or flutter, no rumble and no acoustic feedback.

In mid 1980, Philips and Sony made a formal presentation of the proposed system to the world hifi industry and put up a very convincing case. Indeed, it was so convincing that, without necessarily closing off their own options, something like 40 companies took out licences to manufacture hardware and software for what has come to be known as the Compact Disc (CD) system.

(At the outset, Sony seemed rather keen on the name "Digital Audio Disc" — abbreviated to DAD — but Philips appear to have got their own way with "Compact Disc", as a companion device to the Philips-developed "Compact Cassette").

WIDE SUPPORT

Without trying to list all the names of current CD licences, those which are most familiar in Australia include (in alphabetical order): Akai, Bang & Olufsen, Dual, General Corp, Grundig, Hitachi, Matsushita (National, Technics), Mitsubishi, Nakamichi, Nippon Marantz, Onkyo, Philips, Sansui, Sanyo, Sharp, Sony, Studer-Revox, Teac, Toshiba, Trio, CBS, Nippon Colombia, Pioneer, Polygram and Toshiba-EMI.

In the two years or more that have followed the signing of the licensing agreements, the companies concerned have been hard at work developing their own techniques and their own prototypes, and generally adding to their store of knowledge and resources.

Indeed, through most of '82, it seemed that everyone was getting ready to swim, but that no one wanted to be the

WAVEFORMS AND CONTOURS

Listening to the complex sound which often emerges from a hifi system, readers are often nonplussed by the thought of a stylus which is required to vibrate "at all those frequencies at the one time". It may be helpful, in understanding the present article, to think in another way of what goes on.

When an orchestra is playing the auditorium is normally filled with a complex pattern of sound waves, most of which impinge on the listeners' eardrums. Being physical entities, eardrums cannot be in two places at once, nor can they be moving simultaneously in opposite directions. What they do is to take up positions and move in sympathy with the sum of all the individual pressures acting on the drum. The marvel of it is that, given only the sum or the contour of the external pressure wave, the human hearing can reconstitute the component frequencies, along with their relative amplitude and phase.

In microphones, the diaphragm also responds to the instantaneous sum of the pressures affecting it and the unit delivers an electrical output signal which has an equivalent sum or contour pattern.

Similarly, a recording stylus does not record each individual frequency, as such. Deviations in the groove are proportional to the instantaneous sum signal. In effect, the groove is a half-kilometre-long graph of the summed signal, plotted against time – 20 minutes or so. This being the case, it is helpful to consider the replay stylus as having to follow a contour, rather than a countless number of individual frequency waveforms.

The digital record/replay system, which is the basis of the new compact disc, also seeks to analyse and reconstitute sum signals; hence the concern with wave patterns and contours. It's really no different to what is preserved in an analog groove; it's just that it's done in another way!

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first to jump in. Then, suddenly, it was on!

Sony led the way in mid-October with an announcement release timed for about March '83. Philips chimed in a few days later, with Marantz circulating their own glossy circular. National/Technics were slightly less forthcoming but lost little time in supplying us with full information on their SL-P10 system. Sharp revealed that they were assessing a model for Australia. And so on.

In short, by the time you've digested this article and pondered for a while over your cash balance, the chances are that the first compact discs and players will have appeared in the major hifi shops to tantalise and unsettle you!

THE DIGITAL CONCEPT

But, before we say any more about them, let's go back to that word "digital" and see if we can explain what it means.

Instead of preserving the actual signal contour as a groove in a disc, a magnetic pattern on a tape or an optical pattern on a movie film, the digital approach is to "sample" or measure the amplitude of the audio signal at rapid intervals and to record those measurements for future reference.

Using such figures, it is theoretically possible substantially to reconstitute a waveform, when required, without ever having had access to the original.

As an elementary illustration, let's say that the waveform of Fig. 1 is superimposed on a graph, such that its amplitude, plus and minus, is referenced to the vertical scale, with time displayed on the horizontal scale.

Reading the graph to the nearest whole numbers, for the sake of simplicity, one could record that the signal amplitude at the successive time intervals follows the sequence: 0, +3, +2, +3, 0, −3, −2, −3, 0, +3, +2, +3, 0, −3, −2, −3, 0.

Using those figures, one could construct a waveform such as that shown in Fig. 2b. It could be done graphically or, given a DC voltage source and suitable electronic gadgetry, it could be reconstituted electrically.

It might seem to be a rather futile exercise, because Fig. 2b is only a crude approximation of 2a. However, it is interesting to note that, by trebling the number of readings or "samples" along the time scale, the result is 1c, which looks much more like the original.

It would look even more so, if it were passed through an audio top-cut filter to remove unnecessary high frequency components. The filter would have the effect of rounding off the corners of the sampling steps and producing a smoother waveform, much closer to the original.

As we said earlier, Fig. 2 is intended to be basic and to illustrate a principle. Unfortunately, readers encountering such a diagram for the first time tend to baulk at the highly serrated waveform and to assume that that is what is being recovered from a digital recording and fed to the amplifier. Logic says that it must sound coarse or unnatural — and it is an impression that dies hard!

In fact, the sampling rate used for

From the Sharp Corporation:

From the Sharp Corporation, this model DX-3 compact disc player employs vertical front loading, with the disc partly visible on the left. The display at top right shows the relative position of the read head, while the figures below it show the track number being played and the playing time. Along the bottom are the manual controls and the automatic program selection system.

digital sound recording and playback is very high, lying typically in the region 40-50kHz and way above the range of human hearing. It is also normal practice to insert a sharp top-cut filter in the signal recovery (or playback) system, cutting off around 20-22kHz and substantially eliminating all trace of the sampling function from the wanted signal.

The end result is that, for a well designed digital record/replay system — and the compact disc certainly qualifies for that description — the reconstituted signal contour is a more accurate replica of the source signal than can be achieved by any practical analog system.

This is evidenced repeatedly by figures for total harmonic distortion (THD) which are improved by one to two orders of magnitude — 10 to 100 times — compared with signal sources normally available in the home. (Sony quote 0.01% max. THD for a CD disc and player, and 1.0% min. THD for an LP disc and player).

(One should hasten to add that this does not mean an improvement of that order in the sound as heard, because the perceived quality is still limited by the loudspeaker system, the acoustics of the listening room and even the listener's own ears. What it does mean is that the performance of the disc source becomes commensurate with that of the amplifier and ceases to be the potential liability that it traditionally has been.)

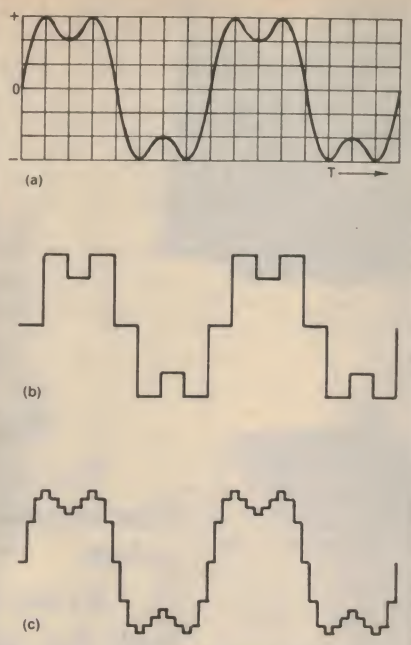


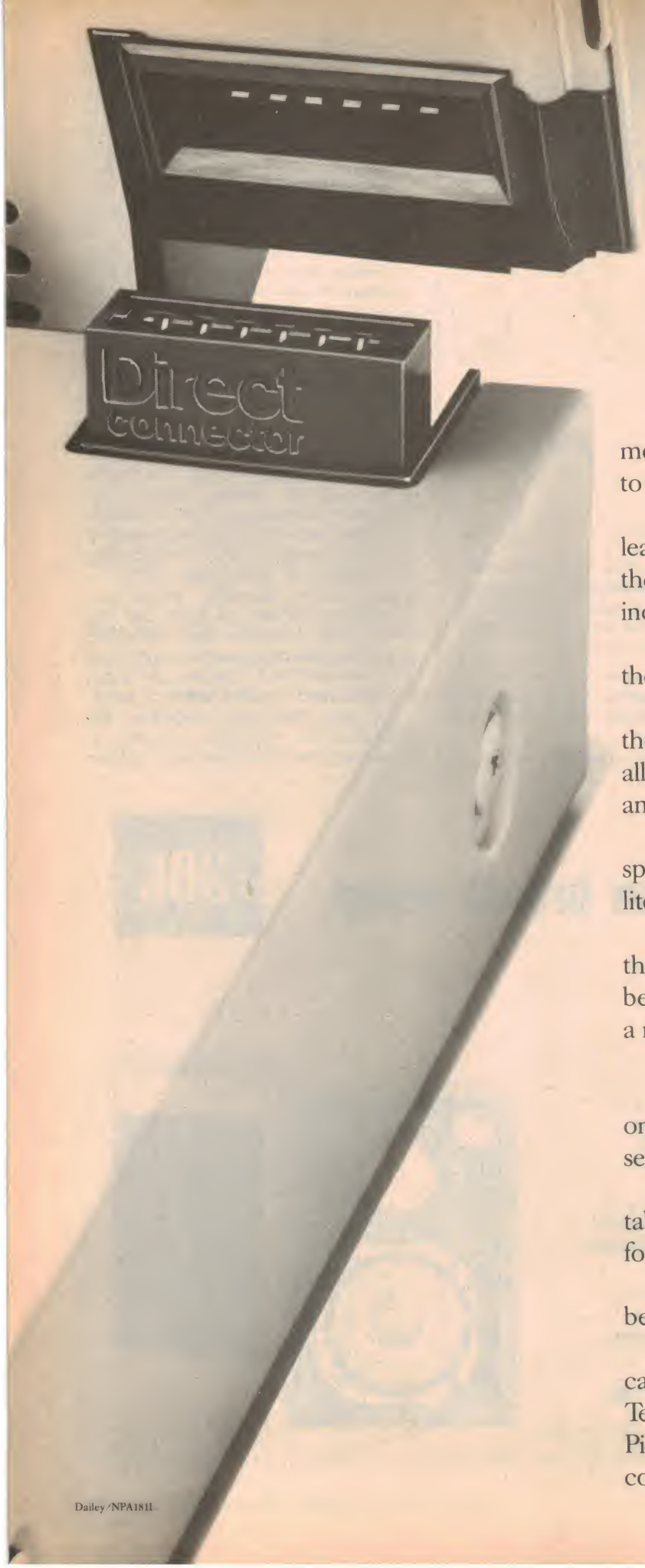
Fig. 2: Illustrating how a waveform can be reconstituted by graphical means. The greater the number of "samples", the more precise does the waveform become.

Results of this order are possible only because very advanced technology has been developed for the specialised task of sampling the signal to be recorded and turning it into a string of numbers — a process described as A/D or analog/digital conversion. It is, of course, fundamental to the production of the compact disc.

The reverse process takes place in every compact disc player: D/A or digital/analog conversion, to produce an analog signal suitable to feed into a standard hifi system. What has made it all practical, even routine, is the LSI or large-scale integrated circuit, which compresses A/D and D/A conversion — indeed the whole audio "numbers" game — on to a few mass-produced silicon chips, each containing typically thousands of transistors.

But that is only the beginning; the "numbers game", as we have described it, draws heavily on computer techniques, with numbers translated into the zeros and ones of the binary system and into a lightning-fast stream of information "bits" — assembled, stored, shuffled, processed and fed out again, like any other digital computer data. What that means in detail must form the subject of a separate article but certain points can be highlighted for our present purpose.

Like any other digital procedure, the emphasis is directed primarily at preserving intact the information pattern



Why Direct

Don't tangle with Technics.

The majority of audio systems – even the most beautifully designed – have something ugly to hide.

It's that mass of jumbled-up connecting leads that you find, all too easily, at the rear of the equipment. Not only are they ugly, they're inconvenient, too.

And as audio components become smaller, the problem becomes bigger and more unsightly.

To solve this problem, Technics developed their Direct Connector systems, which eliminate all audio connecting leads between the tuner, amplifier, graphic equalizer and cassette deck.

Each of these components features a special flip-up connector to allow them to be literally plugged in to each other!

It's an elegant piece of Technics technology that results in a stylish, neat installation that can be put together or taken down for re-location in a matter of seconds.

The 315 Series.

But Direct Connector capability is not the only innovative feature in this new and compact series from Technics.

The SL-5 direct-drive, linear-tracking turntable employs its own plug-in connector system for the pickup cartridge.

This unique Technics development has been adopted as a World Standard.

It means you can compare and evaluate cartridges from leading manufacturers like Audio Technica, Ortofon, Shure, Stanton, Empire, Pickering, ADC and, of course, Technics without conventional setting up procedures.

Technics developed Connector systems.

No adjustment of tracking weight or bias correction is needed.

The innovations continue in the rest of the components: the SU-5 amplifier includes a Super Bass switch to enhance the bass response of a speaker system without inducing bass boom; the ST-5 quartz synthesizer digital tuner provides random access memory for 16 pre-set stations; the SH-E5 graphic equalizer – offers adjustment of 12 audio bands from 16Hz to 32Hz on each channel; whilst the RS-5 cassette deck – has soft touch controls, auto selection of metal, CrO_2 and normal tape settings plus convenient Cue and Review functions.

Finally, a pair of SB-F5 speakers with horn-type tweeters and bass reflex porting turn the high quality electrical signals of the rest of the system into the high quality sound you expect.

Compact components, full-size warranty.

All components in this series are perfectly matched in styling and performance.

And all are covered by a full 2-year warranty backed by Technics' reputation. Visit your Technics stockist soon and experience the superb styling and brilliant sound of Technics' compact Series 315 for yourself.

Technics 2 Two Year Warranty

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THE COMPACT DISC — continued

of ones and zeros, expressed as the presence or absence of signal at the appropriate time intervals. The linearity of the circuitry or the recording medium plays no part in accurately preserving the waveform contour.

A further point is that modern digital systems do not simply record and decode the raw digital data. During the past decade, computer engineers have devised various ways of reorganising digital data, adding "parity" bits, etc, so that the processing circuitry can automatically sense and correct anomalous bits of data and even cope with signal drop-outs.

The error correcting facility reduces still further the chance of a digital system producing spurious signal voltages — or noise. In practice, digital recording and playback offers a very substantial improvement in signal/noise ratio and dynamic range.

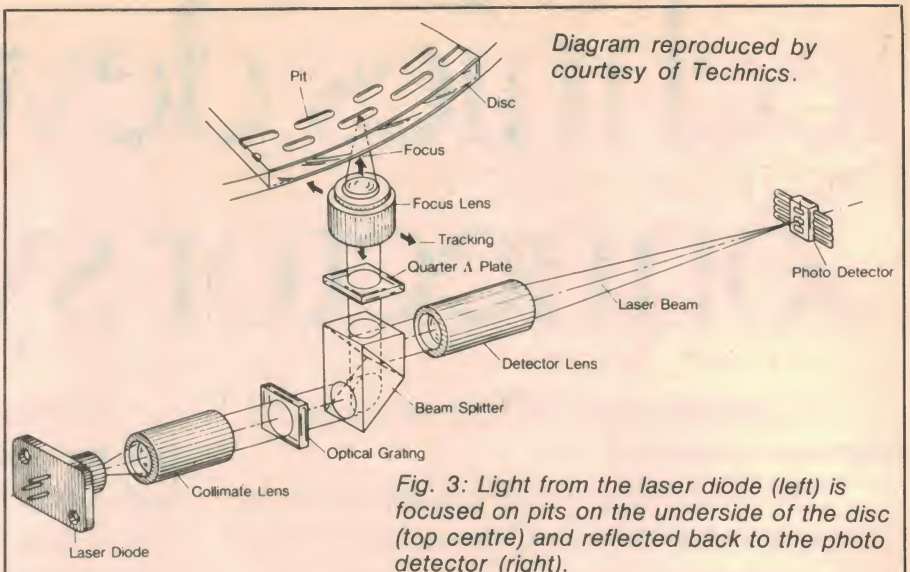

Diagram reproduced by courtesy of Technics.

Fig. 3: Light from the laser diode (left) is focused on pits on the underside of the disc (top centre) and reflected back to the photo detector (right).

The error correction system adopted by the industry for the compact disc is known as Cross Interleave Reed Solomon Code (CIRC) which Sony say can cope with error bursts affecting up to at least 4000 bits, caused by possible disc production faults, or by gross fingermarks or scratches. Technics puts it another way: the chances of a complete signal dropout are about one occurrence for each 5000 years of normal playing!

Another major refinement in the CD system is that the accuracy and uniformity of the replay signal speed is no longer dependant on either the recording or replay turntable drive. Perhaps it's just as well, because the CD system is based on a constant lineal scanning speed and therefore requires a very precisely controlled variable speed turntable drive motor.

Standard practice is to play from the inside (50mm dia) towards the outside (116mm dia) with the disc spinning initially at about 500rpm and gradually slowing to 200rpm as the replay head follows the data track outwards.

The turntable motor, normally a precision, direct-drive type, operates under crystal-locked servo control to ensure that a stream of samples is read from the disc at the standard CD system rate of 41.1kHz (per channel). However, the samples are not decoded immediately but are loaded into a memory chip, which acts as reservoir.

The samples are subsequently clocked out of the memory bank at precise intervals, determined by the crystal, at 41.1kHz per channel. Since the output is buffered by the memory bank, slight vagaries of the motor and turntable cannot produce wow and flutter which, in the specifications for a CD player, invariably read "immeasurable".

Nor is any problem to be expected from turntable rumble and acoustic feedback. The laser read head is mounted on a servo-controlled traverse mechanism, which automatically follows the track outward and automatically follows any slight warp in the disc, to keep the laser focused on the under-surface. Having in mind, also, the small, rigid nature of the disc, it is most unlikely that anything to do with the mechanics or acoustics of the turntable could penetrate the signal system.

And what of channel separation? While the left-hand and right-hand signals share the one data stream on to and off the disc, they are never quantitatively combined in any way. The respective information bits simply alternate in time; and, during decoding, they are switched this way or that to entirely separate D/A converters and thence to the hifi system through entirely separate buffer amplifiers. As a result, channel separation is far greater than the 25-odd dB that one expects from an LP system.

The Technics SL-P10 compact disc player

In a subsequent article, we plan to have a closer look at what goes on inside a CD player but, in the meantime, Fig. 3 illustrates the basis of the system. The information "bits" appear as microscopic pits in the silvered underside of the disc. They are read by the beam from a laser diode and the amount of light reflected into the photodetector varies according to whether the laser beam is falling on the under surface of the disc or a pit. The photodetector interprets the variations in light as digital pulses.

Typical specifications:

Sampling frequency	44.1kHz
Disc diameter, thickness	120mm, 1.2mm
Scanning velocity	1.2-1.4m/sec
Playing time	60 mins plus
Frequency range	5Hz-20kHz ±0.5dB
Dynamic range	more than 90dB
Signal/noise ratio	more than 90dB
Channel separation (1kHz)	more than 90dB
Harmonic distortion (1kHz)	less than .004%
Wow and flutter	immeasurable

Listen to music the Technics Way

Ever since the Sony Walkman was introduced several years ago, personal portables have enjoyed great popularity and have been sold in large numbers. Now Technics have produced the Way which they claim is the smallest portable player of the lot.

Dimensions of the Way are barely larger than the length and width of a standard cassette at 108 x 75 x 30mm. Mass with two penlite cells and a cassette fitted is just under 300 grams. But if the player itself is to be regarded as small the headphones themselves must be looked upon as vestigial. They are of the supra-aural type employing samarium cobalt magnets for high sensitivity. They have an adjustable headband and on the model we reviewed, a tie clip which functions as a play/pause control.

There are three models of the Way which, although differing in appearance, are all electrically identical. At one end of the unit are two buttons for Start and Stop and two 3.5mm stereo phone jacks for connection of two pairs of headphones. Only one pair of phones is supplied at purchase.

The fast forward and rewind buttons on the side of the unit actually depress the tape hub drives slightly to activate these modes. On the side of the unit is a three-way switch to accommodate standard and high coercivity tapes plus metal tape. The volume knob is a small thumbwheel control.

As might be expected current drain from the batteries is fairly high, leading to relatively short life of only a few hours. During play, the current drain is typically around 110mA and between 130 to 160mA for fast forward and reverse, rising to 300mA at end of tape in these two latter modes. In the play mode there is an automatic stop at end of tape which saves the batteries; ie if you have nodded off.

Technics have recognised the problem of short battery life of the internal penlite cells and have provided an accessory battery adaptor which holds two D-size cells which should have much longer life. The adaptor can be clipped to the user's belt when on the move.

Sound quality of the Way portable player is surprisingly good which is probably a testimony to the calibre of the headphones more than to the player's circuitry. Technics point to their "anti-rolling mechanism" which is claimed to counter motion-induced wow and flutter but wow is audible and would seem to depend to a large extent on the particular cassette being played. In any case, rapid motion, as during jogging does make wow and flutter more noticeable.

What the Way (and all other personal portables) does need is some sort of noise reduction circuitry. Unfortunately, the 3V supply rail employed presently prevents the use of Dolby-B but National Semiconductor Corporation's DNR system is now a possibility. For the time being though, the Way does produce some hiss which is more or less noticeable, depending on the program material being listened to.

Opening the lid of the Way reveals a cassette compartment with the head and pinch roller attached to the lid. The electronics and motor plus batteries are all accommodated in a case thickness which is less than 15mm. What a marvel of miniaturisation! We would have liked to have looked at the internals of the unit but the necessary disassembly job was daunting – what if we had not been able to put it back together?

Apparently Technics were able to achieve this new level of miniaturisation by employing a flexible printed circuit board and a very compact motor using new technology. The flexible PC board fits over the tape transport motor and thus utilises space very efficiently.

The motor is said to be "high torque rare earth magnet coreless DC motor". The armature winding is flat and has no iron core (hence, coreless) and, as can be imagined, this leads to a very thin motor. As far as we can determine, the motor has a conventional commutator but the armature is fixed and the magnet rotates. This is the reverse of the conventional permanent magnet motor configuration whereby the armature rotates.

At this stage we know nothing of the circuitry of the player but it seems highly likely that all the active circuitry would be accommodated within one or two integrated circuits.

Whether you regard the Way as a neat source of personal sound or as an exercise in the art of miniaturisation, it really is impressive and deserves to be popular.

The three models of the Technics Way personal portable cassette player are available from electrical and hifi retailers throughout Australia.

Pictured above are the three models of the Technics Way. We reviewed the RQ-SJ1.

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Ref: EA Jan 1981
Great effects for your guitar! Our kit includes a heavy gauge die-cast box and heavy duty foot switch.
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"Guitar Booster" ★

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Unbelievable!! Two realistic sounding canaries chirping away! They will chirp as long as you "feed" them on a 9V battery!
NORMALLY $14.95
FEB ONLY $13.45

"Cudlipp Cricket" ★

Ref: EA Feb 1982
Cudlipp, the electronic chirping cricket that talks when you talk. Crazy! USES a VOX switching circuit to detect noise.
NORMALLY $12.50
FEB ONLY $11.25

"Metronome" ★

Ref: EA Jan 1982
This clever design uses the unique 2N6027 (D13T1) PUT. Rate can be varied between 30 & 160 beat/minute. Even at maximum volume the current drain is less than one milliamp!
Complete with case NORMALLY $16.95
FEB ONLY $15.25

"Fluoro Starter" ★

Ref: EA Oct 1982
One of our most popular kits. Enables you to replace the electromechanical starter with an electronic one! The Fluoro starts up instantly, without a flicker!
All electronic components supplied including high quality mains cap. (Fluoro starter case required)
NORMALLY $5.00
FEB ONLY $4.50

SIMPLE EA KITS

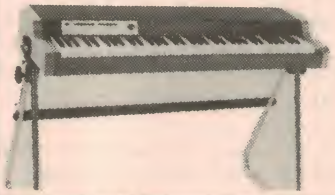
Lyrebird Piano Kit NEW LOW PRICE...

6 OCTAVE $475

NEW LOW PRICE!! Because we are shipping keyboards and other expensive components in bulk due to high demand, we can pass savings on to YOU.

You can now have a magnificent "Lyrebird" 6 octave touch sensitive piano now for only $475!! That's a staggering $50 off the old price.

REMEMBER!! THE LYREBIRD OUTPERFORMS READY BUILT PIANOS COSTING UP TO THOUSANDS OF DOLLARS MORE. WHY PAY MORE WHEN YOUR CONSTRUCTION KNOWLEDGE CAN SAVE YOU A FORTUNE?



7 OCTAVE (88 NOTE) VERSION $589

REF: EA 11/81-1/82

GREAT NEW FEATURES!!

- FREE! A stand (like the one illustrated but not exactly the same). Worth around $50 but yours at no extra charge with each 73 or 88 note kit.
- FREE! A soldering iron (worth around $19). Yours to keep to give years of faithful service after you have completed your Lyrebird (88 note only).
- FREE! A 200g roll of solder. You will need some to build the Lyrebird but there will be plenty left over for other projects. (73 & 88 note versions)
- FREE! Quality IC sockets provided in both kits.

syntom

★

Original design from the UK magazine "Electronics and Music Maker" April 1981. Self-contained unit produces a variety of fixed and falling pitch effects. Trigger by tapping the unit itself or by striking a drum to which the unit is attached. The Jaycar "SYNTOM" comes complete with high quality pre-drilled moulded all ABS box 152 x 80 x 47mm with professional silk-screened front panel.

FEATURES: Decay from less than 0.1 second to several seconds, pitch control, sweep control and volume on/off.

ONLY $36.50 — 10%

SUBWOOFER SYSTEM
10% OFF SYSTEM
PRICE FEB ONLY ★

THE SUB-WOOFER

MODEL SW 250

$79.50

This unit has been extremely popular with audio enthusiasts right across Australia! EA have designed a special crossover/booster amp just for this unit. Now you have no excuse to build a subwoofer system to enjoy those thrilling low notes from pipe organs, synthesisers, 1812 cannons etc!!

SPECS:
Diameter 10" (250mm) Cast Frame. QT=0.39. VAS=631
Power Handling = 100WRMS.
Free-air Resonance 32Hz ±1Hz
Voice Coil = 2" (51mm). Dia.
Magnet Assy = 3kg (6.6lbs).
A FREE SUB-WOOFER CABINET DESIGN IS PROVIDED WITH EACH UNIT!!

AMPLIFIER/FILTER UNIT

AMPLIFIER/FILTER UNIT.
Amplifier Module $79
Transformer to suit $39.50
Metal case specially made to suit including front panel, hardware etc. (not a twin 25 case). Only $29.50
$148.00

Buy the lot for only $125.00 if you purchase the enclosure and woofer at the same time.

REF. EA JULY 1982

State-of-the-art power Mosfet technology combined with an active low pass filter results in a sub-woofer amp without equal anywhere!!

FEATURES: Around 100WRMS Drive capability.
Low pass (sub-woofer) filters on board.
Can hook-up to pre-amp out or power-amp out.
Power supply on board.
(Transformer needed. ONLY $39.50)

ONLY $79

THE ENCLOSURE

This compact 63 litre vented enclosure was specifically designed around the parameters of the SW250 Sub-Woofer. It follows the theory pioneered by the work of Thiele, Small and Snyder. The Jaycar enclosure is easy to build and is made of high quality durable materials. The heavy walled cabinet is covered with an attractive black vinyl veneer. All timber is pre-cut and the black grille is already made. Assembly takes less than one hour.

NB. The photo shows the prototype which was finished in white. The production units are only available in black

Freight anywhere in Australia only $10.00.

ONLY $79.50

500MHz Digital Frequency Period Meter

REF: EA Dec '81 – Feb '82

★ ★ ★ ONLY $119

Other people may appear to be selling this kit for less. But you GET less!!!
Exclusive Jaycar features:
* Heavy gauge front panel. Pre-punched and silkscreened. (NOT Scotchcal). * Low aging rate 10.000MHz crystal * Quality IC sockets provided (A MUST) * All metal film resistors used (1% 50ppm) * Thermalloy heatsink for +5V reg.

Beware of advertised units that do not conform to the original design. They may have inferior performance.

EXCLUSIVE
Gold plated BNC Input Connectors
500MHz option only $26 extra
50MHz version $119
Tilting bail to suit ONLY $4.95

Function Generator

FREE! TILTING BAIL WORTH $4.95 included

Ref: EA April 1982

$99

"Pigeon Pair" companion to the new 500MHz DFM. Low distortion generator of sine, square and triangular waveforms. From below 20Hz to over 160kHz. Inbuilt 4 digit frequency counter in de-luxe Pac-Tec case. Only $85.

JAYCAR EXCLUSIVE 1% 50ppm metal film resistors used for stability.

BOTH OF THE ABOVE NORMALLY $244 FEB ONLY $220!!

KITS SALE ★★★★★

A (★) ARE 10% OFF FOR THE MONTH OF FEBRUARY ONLY. HURRY!

Digital Thermometer

$69

EA2/82

Read the temperature in your room (or outside) from 0 degrees C to 100 degrees C in fact to within 0.1 degree C. Fantastic resolution on a bright easy-to-read display. Includes case.

DIGITAL CAPACITANCE METER

Ref: EA 3/82

This kit once again uses the amazing DPM 200 LCD /driver module. Capable of measuring capacitance from 1pF to 19.99uF. It is a must in every workshop or lab.

$69

HEART RATE MONITOR

Ref: EA 7/82

WAS $79

SAVE $10

This unit enables you to measure your own pulse instantly and accurately. It is light enough even for joggers to carry. A must for people who may have heart problems. Complete kit including LCD Display.

NOW **$69**

DIGITAL pH METER KIT

10% OFF FEB ONLY

NORMALLY $69.00

NOW $62.10 ★

EA CAR COMPUTER KIT ★

$143.10

Ref: August EA 1982

We've said enough about this kit. No details here — read our previous ads!

At present (time of ad going to press) our price is the lowest for the complete kit, at $159.00 (Including both sensors).

February ONLY $143.10

(sorry only tailshaft sensor at this price!) (+ fuel sensor of course)

If you require the Speedo Cable sensor we have them at $29.50 ea.

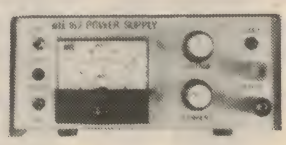
TRANSISTOR ASSISTED IGNITION

Ref: EA January 1983. Latest version of this fantastically popular kit!! The Jaycar kit comes with a genuine DIE CAST box — as used in the EA prototype. Beware of others that use flimsy sheet metal boxes!! Ask us about the OPTO option.

ONLY $35

0–30V 1amp power supply

Ref: ETI December 1982



$49.50 complete

'Power UP' ★

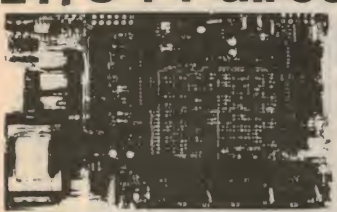
Ref: EA 11/82

NO ROOM FOR DETAILS

$39.50 -10%

ETI 644 direct connect modem

Ref: ETI October 1982



SHORTFORM KIT **$169**

FULL KIT **$189**

Two models (i) Short form which contains ALL PCB components as specified by ETI (BEWARE!!). The genuine ETI PCB with plated-thru holes, solder mask and component overlay is supplied. We also supply at NO EXTRA CHARGE a full set of quality I.C. sockets. A must with plated-thru PCB's **Remember this when making comparisons.**

(ii) Full kit. Includes: all of above plus 12V plugpack, case, front panel, switch and LED bezel and Cannon DB-25 RS-232 connector. Makes a complete stand alonemodem.

*** Capable of a range of Answer/Originate operating modes * Selectable Baud rate * Software controlled * Uses new patented technique * More reliable and faster than most acoustic modems.**

EA Dual Tracking Power Supply

Ref. EA March 1982

One of our most popular kits!! Can provide dual voltages (+) from 1.3V to 22V at up to 2 AMPS. In addition the supply features a fixed +5V @ 0.9A. The output is protected against short circuits, over loads and thermal runaway.

ONLY $89 COMPLETE

ETI 330 Car Alarm ★

Ref. ETI July 1981

This unique design detects the voltage drop that occurs across the strap that connects the engine block to the chassis. It does not use wiring inside the car where false triggering can take place. Kit comes complete with all components and metal work (die cast box).

NORMALLY $29.50 FEB ONLY $26.55

ETI 492 Sound Bender ★

Ref. ETI Feb 1982

Short form kit of a device to give either your voice, musical instrument or other source that Dalek, metallic sound as well as other sounds!

NORMALLY $24.50

FEB ONLY $22.05

ETI 445 General Purpose Preamp ★

Universal Stereo pre-amp. Flexible configuration allows you to use it as RIAA (Disc), NAB (Tape) or as a 'flat' pre-amp with fixed gain!

One day you will need one of these!

NORMALLY $7.99

NOW IN FEB $7.19 WOW!

ETI 446 Audio Limiter ★

Great little circuit that volume compresses when audio level reaches a pre-determined set. Ideal for P.A.

NORMALLY $12.00

FEB ONLY $10.80

ETI 760 RF Modulator ★

Ref. ETI Sept 1981

High quality, stable RF modulator. Less tendency to drift than cheap Hong Kong 'Tin Box' types. Will accept composite video signal and will supply modulated (video) RF on VHF channel 1 (tunable)

NORMALLY $12.99

FEB ONLY $11.69

ETI 499 150W Mosfet PA Module ★

Ref. ETI March 1982

150 RMS watts of pristine Mosfet power. At last a really stable high-power P.A. "Brick" at a realistic price!

NORMALLY $79.50

FEB ONLY $71.55 HURRY!

ETI 498 Preamp for above ★

What can we say? It's on special too!

NORMALLY $39.50

NOW (FOR FEB) $35.55

ETI 479 Bridging Adaptor ★

Ref. ETI March 1982

This clever little circuit will convert your 5000 Stereo 100W Power Amp say a "Black Monolith" to a 300W RMS Mono P.A.! Is nothing sacred?

NORMALLY $9.95

FEB ONLY $8.95

SIMPLE ETI KITS

Train Controller ETI December 1982

Sorry no room for pics! ETI1508 Model Train Controller.

Sorry also. Our kit does not include the metal work but we have reduced the price to $59 per controller.

Polyphonic Organ

Ref. ETI Jan 1983

Here at last! This very popular kit is now in stock.

* "Touch Sensitive" P.C.B. keyboard * Fully Polyphonic * Two voices * 25 notes, 2 octaves * Can operate from battery or plupack (Case not included)

ONLY $49.50

Jaycar NUMBER 1 FOR KITS

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Cnr. CARLINGFORD & PENNANT HILLS ROAD,
CARLINGFORD
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$25 - $49.99 ($4.50) $50 - $99.99 ($6.50)
$100 up ($8.00)

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Mon - Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Mail Order By BANKCARD Via Your Phone

Transistor-assisted Ignition System

We present a revised version of our transistor assisted ignition system originally featured three years ago. Read how it compares with the new "high energy" ignition systems installed on the latest model cars.

by LEO SIMPSON

It is just over three years since we published our Transistor-Assisted Ignition system in December 1979. Since that time it would appear that several thousand of these units have been installed and, by and large, they have performed well. In line with the modest claims made for the system at the time of publication, the major improvement has been increased service intervals for the breaker points and slight gains in fuel economy (up to about 5%). Users of four-cylinder cars have also reported improved engine smoothness.

In the intervening three years since the circuit was published, a considerable number of cars have been made available with breakerless ignition systems fitted as "original equipment", although surprisingly this is by no means universal. A significant number of these breakerless systems are referred to by the car manufacturers as "high energy" systems. How do these compare with our circuit and can our circuit be improved to take note of these recent developments?

Before answering these questions, let us start from the beginning. Many of our readers will not have seen the original circuit published in December 1979 although many may have built the unit from a kit. So for the sake of completeness we will give a full description of the features and the circuit details.

Our new transistor-assisted ignition system offers significant advantages over the conventional Kettering system. For a start, as with other electronic systems, it relieves the points of the heavy burden of coil current switching while still passing enough current through them to keep them clean.

This means that once the system is initially set up it will not be necessary to readjust the system until wear of the rubbing block becomes significant. In practice, this means that every 15,000 kilometres or so, the points should be regapped and the timing readjusted. So, in essence, the car will stay in peak tune for much longer periods than would otherwise be the case and long term economy will be improved.

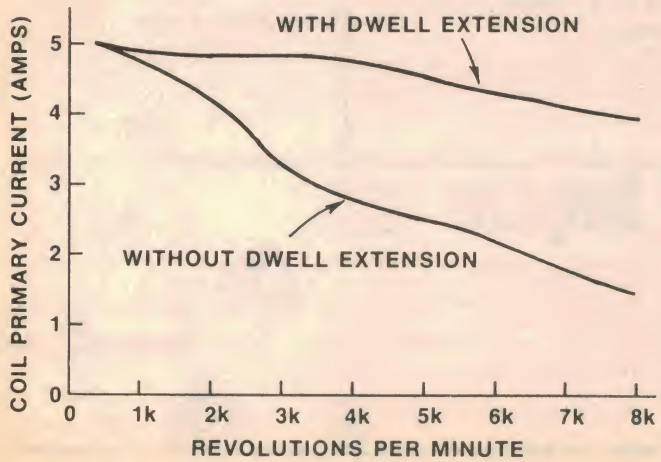


Fig. 1 (left) shows how the dwell extension feature maintains coil current and, therefore spark energy up to very high engine speeds (in this case, for a 6-cylinder motor).

Starting performance of the transistor assisted ignition system can be expected to be on a par with a freshly tuned Kettering system. However, in the conventional Kettering system starting performance normally deteriorates as the points become worn, so as time goes on, the transistor system is superior.

At low engine speeds, the spark energy of the transistor system will be comparable with a freshly tuned Kettering system with new points fitted. This is because the voltage drop across the main switching transistor is less than 300 millivolts when turned on. This is comparable to the voltage drop across a typical set of points when they are reasonably new. As points become worn, the voltage drop may increase to one volt or more at maximum coil current.

As engine speed rises, the spark energy of the conventional Kettering system is reduced due to the relatively slow build-up of current in the coil primary. Our transistor-assisted system maintains spark energy at a high level even up to very high engine speeds by using "dwell extension".

Dwell extension

The term "dwell" refers to the time the points are closed and is measured in terms of degrees of distributor camshaft rotation. Our circuit provides for dwell extension by switching on the coil 0.9 milliseconds after the points open. This means that we have artificially determined the spark duration at 0.9 milliseconds.

The photographs of the oscilloscope waveforms show the performance of the system. The first photograph shows the coil waveform without dwell extension.

At the instant of points opening the coil voltage rises very quickly until the spark

discharge occurs, at which the voltage falls to a relatively low level while the coil secondary resonates with its distributed capacitance at about 10 to 15kHz. When the spark is extinguished, the remaining coil energy is dissipated by resonance in the primary circuit at a much lower frequency.

In a normal ignition system then, the spark lasts for less than one millisecond. Our circuit takes advantage of this fact by fixing the spark duration at 0.9 milliseconds. In the second oscilloscope photograph, the effect of dwell extension can be seen. Note that the main coil transistor is turned on before the primary resonance occurs. This has the effect of increasing the amplitude of the main coil primary voltage (the spike).

By the way, these photographs were taken at the very high spark rate of 300 sparks per second. These are unrealistic figures for normal motoring, corresponding to 4500rpm in a V8, 6000rpm in a 6-cylinder and 9000rpm in a 4-cylinder motor.

At lower spark rates the comparison with normal Kettering ignition is not nearly so favourable but the transistor assisted ignition does give a significant increase in available spark energy from idle speed and up. Whereas the normal system begins to taper off the spark energy from idle speed upwards, the transistor system with dwell extension does a much better job of maintaining spark energy up to spark rates far beyond the capability of normal engines. Fig. 1 illustrates this.

This great improvement in spark energy comes about in two ways. Consider the fact that a normal coil and ballast resistor system takes about 15 milliseconds for the current to rise to saturation (and thus provide maximum spark energy). Since in a 6-cylinder motor the points provide an approximate 50% duty cycle, this means that if sparks are required less than 30 milliseconds apart, the coil current will not reach saturation level. And a 30 millisecond period coincides with a spark rate of only 33 sparks/second or only 667rpm for a 6-cylinder motor.

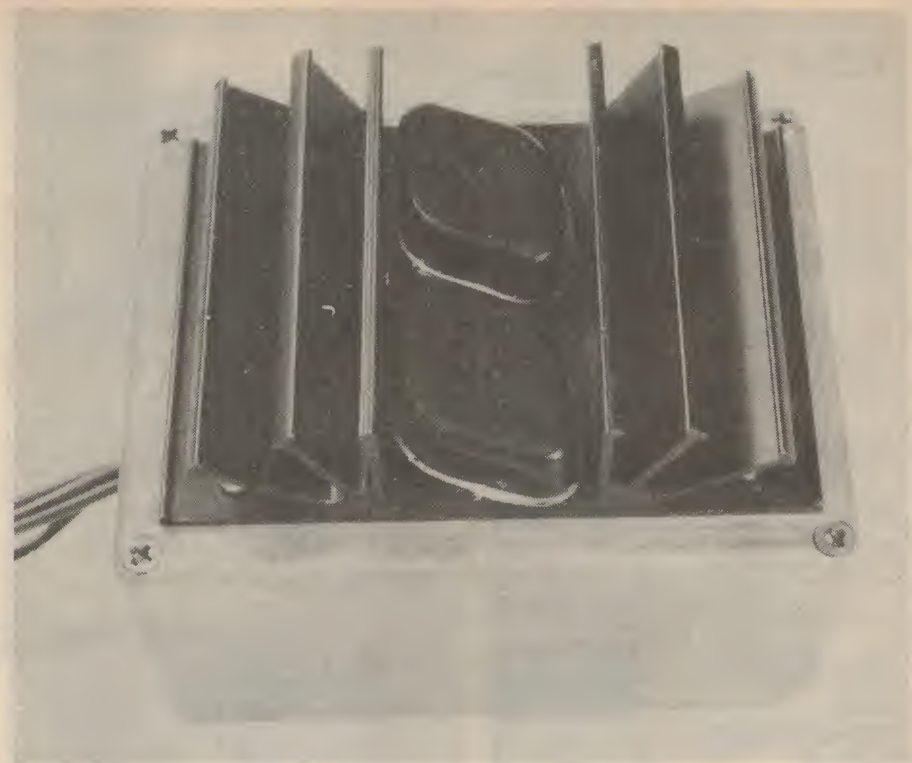
Coil not fully discharged

The main reason for the improvement is not so much the extra time for the coil current to build up but the fact that the coil transistor is turned on before the spark extinguishes naturally and primary coil resonance occurs. The fact is that when the coil transistor is turned on again the coil energy has not been fully dissipated. In fact, after the spark extinguishes there is considerable energy remaining in the coil which is usually dissipated in useless primary resonance.

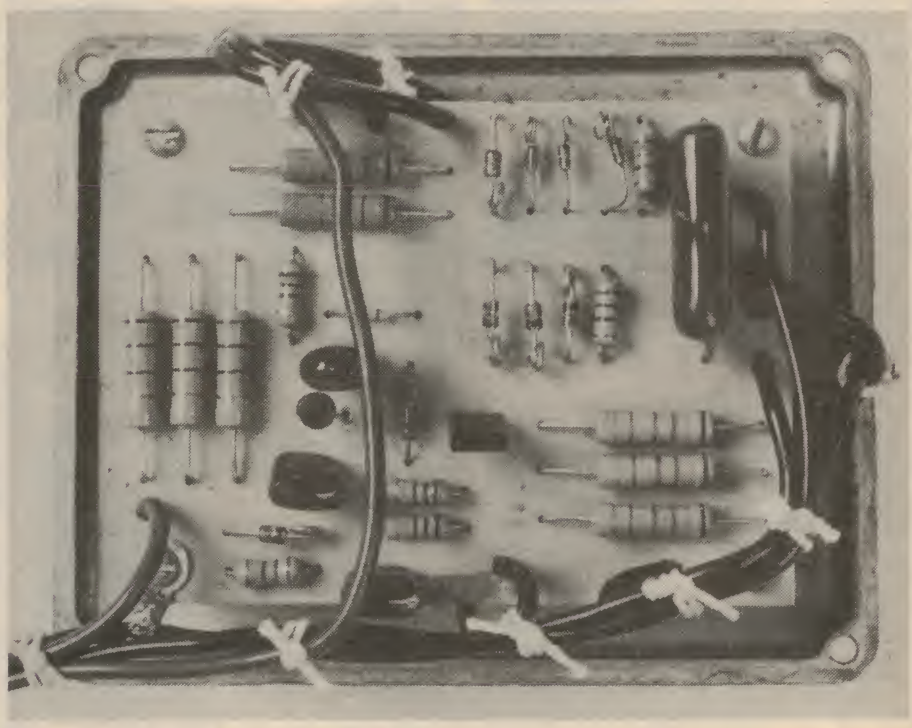
Other features of this transistor assisted circuit are comprehensive protection of both the ignition system components and the electronic circuitry itself, and the ability to drive a standard tachometer without any modifications. Note, however, that impulse tachometers should be connected across the switching transistor (Q4) instead of across the points.

Is there a catch to all this? Are there no disadvantages of this new transistor ignition system compared with conventional or CDI systems? Well there are a few side-effects of the new system but you could hardly class them as major drawbacks.

For example, because of the dwell extension feature, the coil is maintained in saturation for a much higher proportion



The transistor-assisted ignition is built into a rugged metal diecast case. The large heatsink helps dissipate the heat generated by constant current source Q3.

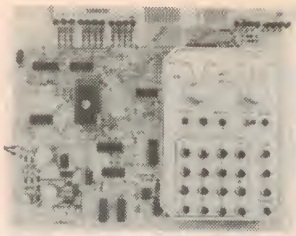


This view shows the assembled PC board. Note that all the diodes are "shock-mounted" by installing them with a loop at one end (see text).

ROD IRVING ELECTRONICS

EPROM PROGRAMMER

$43.00

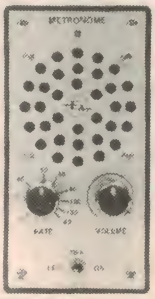


No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms.

With Textool Sockets $55.00
EA January 82

ELECTRONIC METRONOME

$16.90



Great new Metronome Circuit with low current drain (less than one milliamp) drives a Loudspeaker and a Led Indicator. **EA January 82**

3½ DIGIT LCD CAPACITANCE METER

Handy pocket size Digital Capacitance Meter, runs off a 9V battery and measure 1pF to 19.99uF in just three ranges. **EA March 82**

$69.00

DIGITAL THERMOMETER: 3½ DIGIT LCD

$69.00

Measure temperatures from below freezing point to around boiling point. **EA February 82**

LARGE SCREEN TV STORAGE CRO ADAPTER **$119.00**

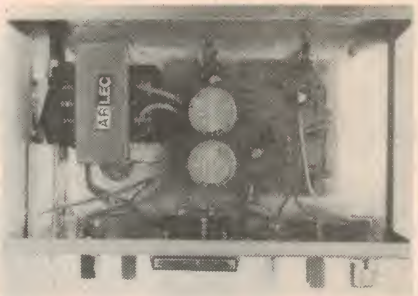
For a low cost Storage CRO with Synchronised Display, Plectronic Graticule, One-Shot Triggering and Optional Storage of up to four Screen Displays it can't be beaten. **EA February 82**

SOUNDBENDER

$29.00

Have great fun creating your own recording effects with music and voice. The Sound Bender can receive from Electric Guitar, Microphones, etc. **ETI February 82**

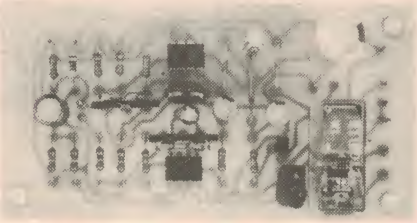
DUAL TRACKING POWER SUPPLY **$83.50**



Built around positive and negative 3-Terminal Regulators, this versatile dual tracking Power Supply can provide voltages from ±1.3V to ±22V at currents up to 2A. In addition, the Supply features a fixed +5V 0.9A output and is completely protected against short circuits, overloads and thermal runaway. **EA March 82**

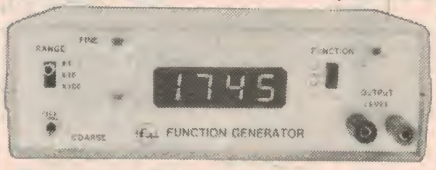
VOICE OPERATED RELAY

$14.95



EA's great new Voice Operated Relay can be used to control a tape recorder, as a VOX circuit for a transmitter, or to control a slide projector. **EA April 82**

FUNCTION GENERATOR **$79.50**



This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 160kHz with low distortion and good envelope stability. It has an inbuilt four-digit frequency counter for ease and accuracy of frequency setting. **EA April 82**

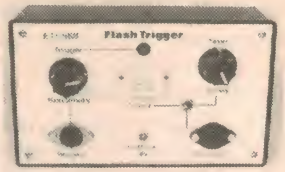
LOW OHMS METER

$34.50

How many times have you cursed your Multimeter when you had to measure a low-value resistance. Well alas, with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms. **ETI 158 November 81**

SOUND TRIGGERED FLASH **$26.50**

This easy to build sound or light operated flash trigger has many feature.



Catch those spectacular and humorous moments like that time your mother-in-law slipped on the moss covered patio and broke her neck. **ETI 568 October 80**

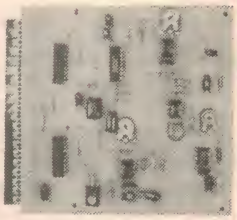
"LE GONG"

$14.95

The "Le Gong" Doorbell with those unmistakable chimes generated by the LSI. A must for the man who has everything! **EA February 81**

LED LEVEL METER

$27.00



Build a Led level Meter with simultaneous peak and average display plus 60dB dynamic range. This kit is ideal for any application requiring a wide dynamic range level display. **ETI 458 June 81**

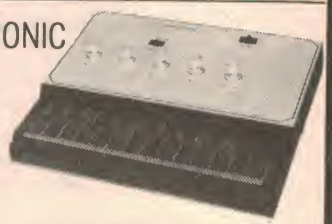
LOTTO/POOL'S SELECTOR

$22.50

You have to be in it to win it . . . Take the chance out of winning the Pools as well as Lotto, and build the great new Pools/Lotto Number Selector. **EA July 81**

ELECTRONIC ORGAN

$59.00

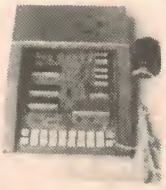


"Electrotune" . . . no its not for your car. It's a 23-note Organ with Special Effects. Singalong with this fun to build Organ and amaze the family and neighbours like never before. **EA July 81**

bankcard

welcome here

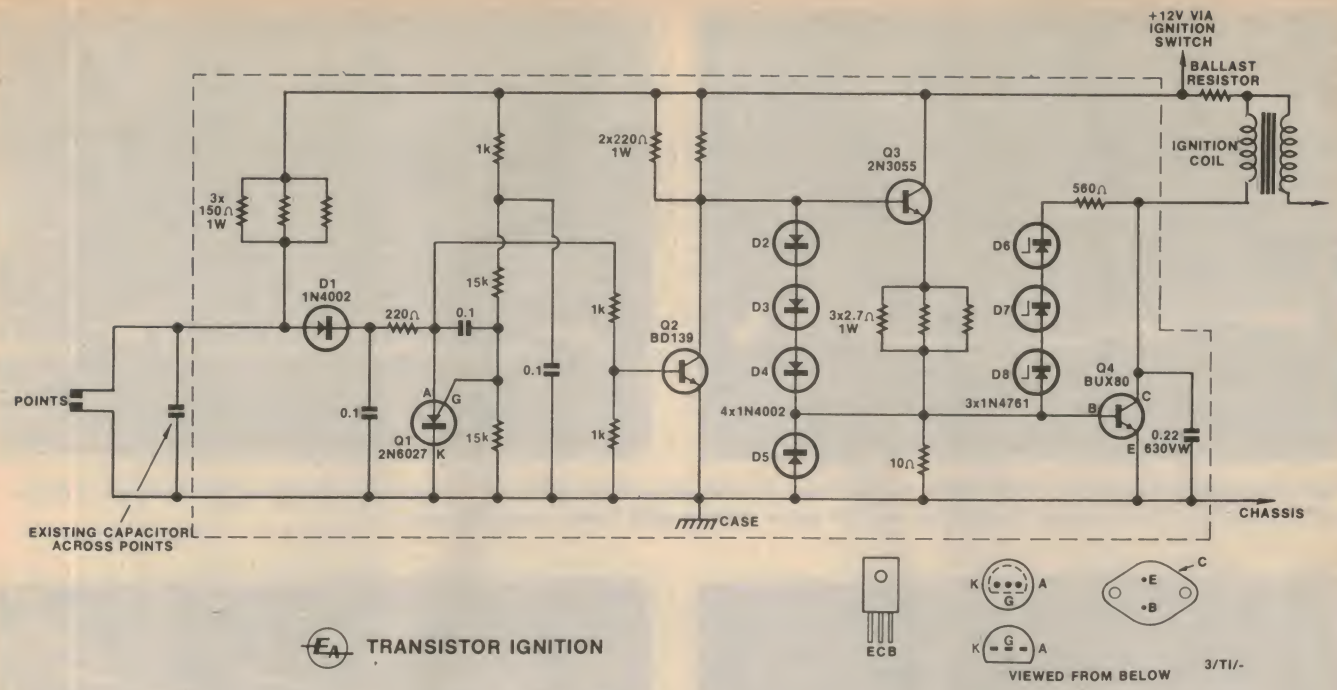
ETI 660 WITH OPTIONS



Kit inc PCB, ICs, Skts	**$99.00**
Colour Option	**$13.50**
Video Modulator In	**$14.50**
Plugpack to Suit 8VAC/1A	**$11.95**
Set of 4 (2114 Rams) 3K Upgrade	**$17.00**
18 Keys plus Scotchcal Labels	**$29.00**

ETI October 81

425 High Street, Northcote 3070, Melbourne, Victoria. Ph (03) 489 8131. Telex No. 38897
Now open at 48-50 A'Beckett Street, Melbourne



HOW THE CIRCUIT WORKS

The heart of the circuit is Q4 which is a rugged transistor especially intended for use in converters, switching regulators and automotive ignition systems. Q4 does the arduous job of switching the coil current. It is protected against excessive voltages by a 0.22μF capacitor and by a string of three 75V zener diodes and a 560Ω limiting resistor between base and collector. Q4 is switched on and off by Q3 which, together with a diode string D2, D3 and D4 and three paralleled 2.7Ω emitter resistors, is set up as a constant current source to deliver 1.3 amps to the base of Q4. This ensures that Q4 turns on hard and has a saturation voltage of around 300 millivolts or less.

Q3 is biased on by two paralleled 220Ω resistors and controlled by Q2. Q2 is turned on and off by the distributor points, via D1. Ignore Q1 for the moment, as it does not control the primary switching function but provides the dwell extension feature.

Three 150Ω resistors in parallel provide "wetting" current through the points to keep them clean in the fume-laden atmosphere inside the distributor cap. Now assume, at the beginning, that the points are closed. This means that Q2 is held off and so Q3 and Q4 are on and current is passing through the coil.

When the points open, Q2 is turned on by base current via D1 and the three 150Ω resistors. Thus Q2 turns off Q3 and Q4 which interrupts the coil current and develops a high voltage across the coil primary. D1 and the associated 0.1μF capacitor form a points "debounce" circuit to prevent erratic triggering.

In the normal course of events, the points will eventually close again, so that D1 ceases to be forward-biased, turning Q2 off and Q3, Q4 on again to recommence the cycle. But Q1 modifies that cycle by turning Q2 off 0.9 milliseconds after the points open. Q1 is, in fact, a programmable unijunction transistor (or anode gate SCR) which works in the following way.

When the points are closed, the anode of the PUT (programmable unijunction transistor) is held close to zero while its gate is held at a little less than half the supply voltage. When the points open, the anode will be lifted up to almost the full battery voltage while the gate, by virtue of the 0.1μF capacitor tied between gate and anode, will be forced up to about 1.5 times the battery voltage.

This 0.1μF capacitor then discharges via the voltage divider made up of two 15kΩ resistors and a 1kΩ resistor. When the capacitor is discharged to the point where the gate voltage is 0.6 volts less than the anode voltage, the PUT triggers on and removes the forward bias from Q2. Q1 stays in the latched condition until the points close again.

So the PUT enables transistors Q3 and Q4 to turn on much sooner than they otherwise could if controlled directly by the points.

The only remaining components requiring comment are the diode D5 and the parallel 10Ω resistor. The resistor effectively ties the base of Q4 to its emitter and thus improves its ability to withstand high voltage. D5 protects the base-emitter junction against reverse biasing.

---

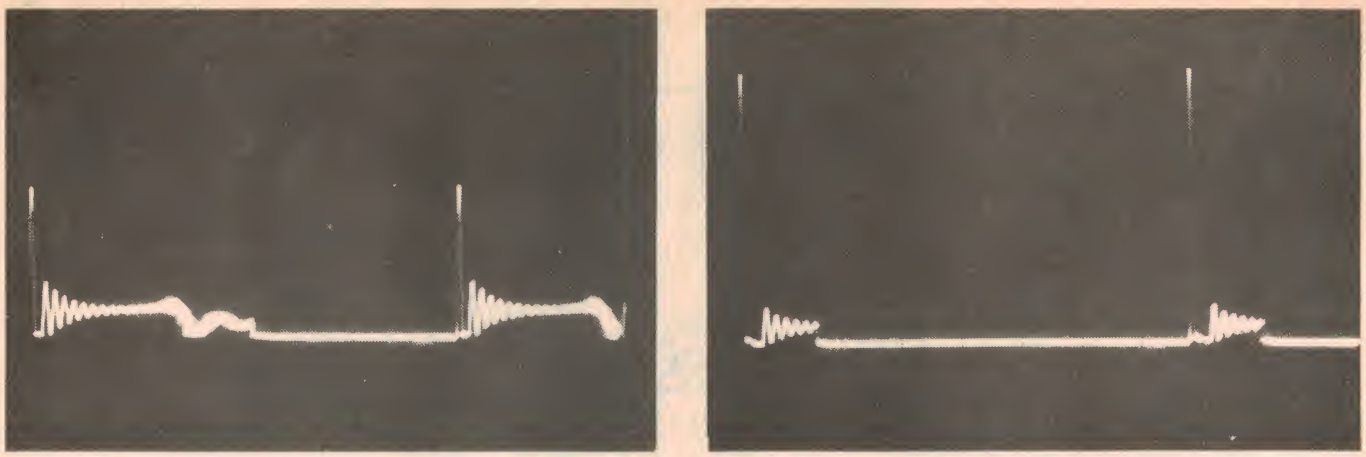
of its operating time. So the average current passing through the coil is about 80% higher. Or, to put in another way, the coil current is increased from about 2.5 to 4.5 amps.

In addition, the transistor drive circuitry draws about 1.5 amps so the total current drain of the transistor-assisted system is around six amps versus 2.5 amps for the conventional system.

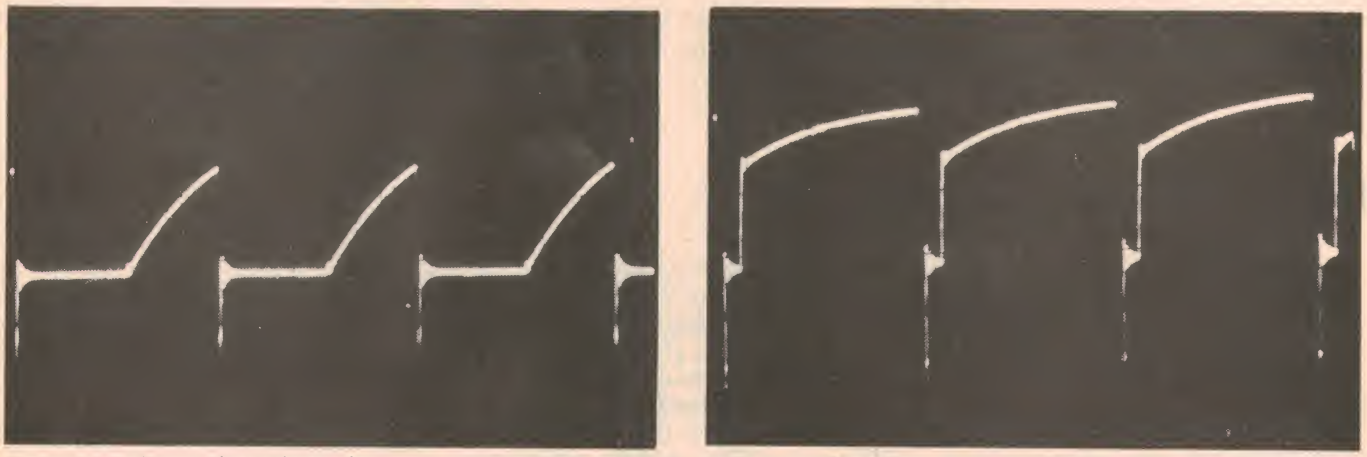
The extra current drain is unlikely to pose much of a problem for the car electrical system but the extra coil current does mean that the coil runs hotter. This has not proved to be a problem for the oil-filled coils on modern cars. Even so, the coil should ideally be placed so that it receives cooling air from the fan.

High Energy Systems

Well, that about sums up the main features of our transistor assisted ignition system. How does it compare with the so-called "high energy" systems now being installed on many new cars such as the Commodore, Falcon and Rover? The most important feature of these systems is not a "hotter" spark or a higher voltage



These two photos show the coil primary voltage from the circuit without (left) and with dwell extension (CRO settings: 50V/div and 0.5ms/div). Note: photos at right are for the older system with 0.6ms spark duration.



These two photos show the coil current without (left) and with dwell extension (CRO settings: 2A/div and 2ms/div).

output from the coil but, rather, a long spark duration, as much as two milliseconds in the case of the Commodore. This is most important in achieving reliable combustion of the generally lean mixtures used in recent model cars. The "high energy" means that the system also has the ability to refire a spark plug if it has been extinguished by turbulence of the mixture.

How do these new electronic systems achieve such a long spark duration? In any ignition system (apart from capacitor discharge types) the spark duration is determined firstly by the amount of energy stored in the coil and secondly by the resistance path presented by the spark plug.

The new high energy systems do not resort to dwell extension (as far as we know) to achieve this greater energy storage in the coil. No, they generally dispense with the ballast resistor in series with the coil and take advantage of the power transistor, which is usually a Darlington, to switch much heavier currents into the coil. Naturally, these systems are breakerless and, with no dwell extension circuitry involved, there is no risk of a coil burnout in the event of the ignition being left on while the motor is stationary. There is also the advantage of a comparatively simple circuit which should be very reliable, as seems to be the case.

Let us state, from the outset, that unless you are willing to modify the coil or ballast resistor in your system from "standard" it is not possible to gain these really long spark durations from the EA circuit. And in any case, we would strongly advise against doing so. Operating a normally ballasted coil without a ballast resistor will burn it out in a short time, probably within less than half an hour.

Even so, readers who are familiar with the original circuit published in December 1979 will realise that we have increased the spark duration from 0.6 to 0.9 milliseconds. There is no benefit in even greater extension of the spark time because the system with standard coil does not store enough energy.

The only result of an attempt to extend the spark beyond 0.9 millisecond (by altering circuit components) will be that the spark will extinguish of its own accord at about one millisecond and the remaining energy stored in the coil will be dissipated in useless primary resonance. As outlined above, the major advantage of the dwell extension feature would then be lost.

We estimate that the current cost of parts for this project is approximately

$35

This includes sales tax.

Don't open up the plug gaps

Before we leave this topic, there is one final aspect which should be noted. In the past, when fitting electronic ignition, car enthusiasts have often increased the spark plug gaps by as much as 50% to take advantage of the higher spark voltage which is usually available and thereby gain a longer spark "path".

(In our previous article we recommended that distributor points and spark plugs be left at normal settings to allow a quick changeover to normal ignition, should this be necessary in the case of a failure.)

But note that we said above that spark

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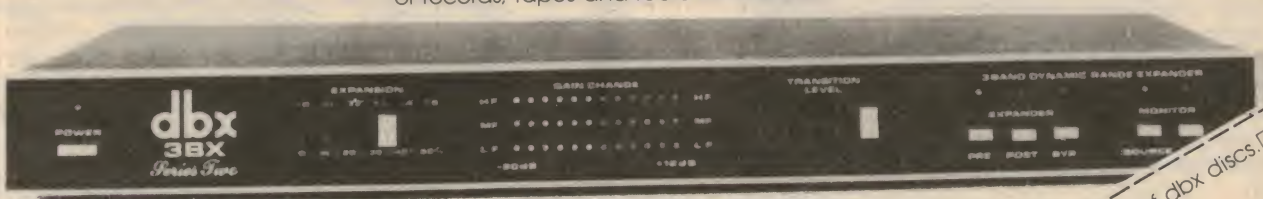

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duration is determined also by the resistance path presented by the spark plug. If the resistance is increased the actual spark duration will be shorter, for a given coil energy storage. So, opening the plug gaps will give a longer spark "path" but it will also give a shorter spark duration. On balance then, there is no advantage to be gained by increasing the spark plug gaps.

Circuit changes

Apart from the change to the spark duration, we have made two other changes to the circuit in the light of three years experience with the system. The first is to change the paralleled base bias resistors for Q3 from 120Ω to 220Ω and the second is to change the mounting arrangement for the various diodes.

The reason for the latter changes is that we know of a number of these systems that have failed because one of the three diodes, D2, D3 or D4, which provide the voltage reference for the current source, Q3, has failed and gone "open-circuit". This causes Q3 to conduct very heavily and burn out its three 2.7Ω emitter resistors. This usually chars the printed board so badly that it also has to be replaced.

By changing the base bias resistors for Q3, it is not likely to conduct so heavily. More importantly, by mounting each diode with a "stress relief" loop at one end, it is less likely to fail.

Elsewhere in this article we give details of an optoelectronic distributor head which can be used with our transistor ignition system. We have mixed feelings about this option. On the one hand, the opto system eliminates the distributor points entirely and should give smoother idling. On the other hand, it precludes the possibility of a quick change back to standard ignition in case of a failure.

While the odds of such a failure occurring are probably fairly long, it does bear thinking about. We have devised a system which gives changeover in a few minutes and which could easily be done by even a "non-electronics inclined" mechanic in the event of a failure while your spouse or relative is driving the car. By contrast, a failure in an all electronic system would probably be a "tow away job".

Construction

The entire transistor ignition circuit is housed in a diecast aluminium box. We used an Eddystone box measuring 93×56×119mm but any diecast box which can comfortably accommodate the PC board and power transistor heatsink will be suitable. A diecast box is preferred to a folded sheet metal box in that it is more rugged and can be made splashproof easily.

All the components with the exception of the two power transistors are mounted on a small PC board measuring 91×68mm and coded 79ti11.

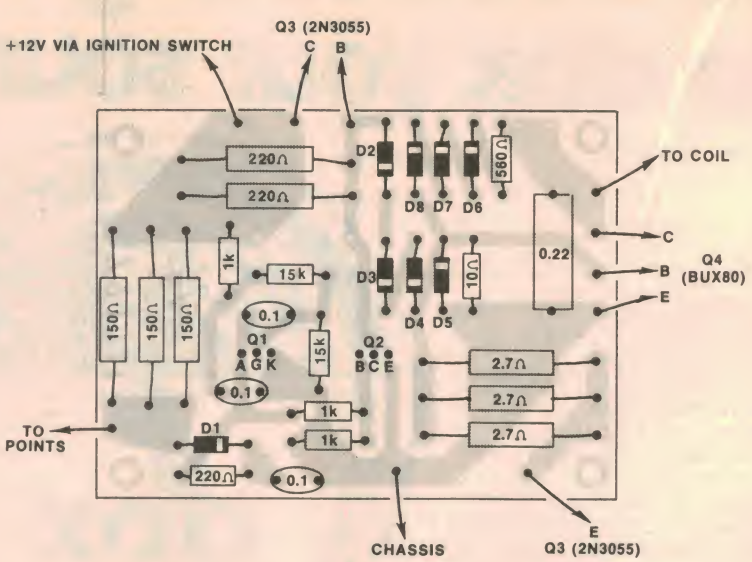
The two power transistors are mounted on the lid of the diecast box together with a single-sided heatsink which is readily available from most kitset suppliers.

If the heatsink does not come predrilled you should first drill it using a TO-3 mica washer as a template. After drilling, remove any burrs by using a large diameter drill. Next, position the heatsink on the lid of the diecast box in such a way that it does not interfere with the lid-securing screws and then punch suitable drill centres in the lid and drill and deburr the holes in the previous manner.

With the heatsink free of any metal shavings or other grit, a thin layer of thermal conducting compound or silicone grease can be applied in the area underneath the transistors and on the mica washer. Some heatsink compounds may contain beryllium, a highly toxic substance, so apply the compound carefully with a cotton bud and avoid skin contact with it. Mount the transistors with the mica insulating washers and plastic bushes in position and then check that the case of both transistors is insulated from the heatsink and lid using a multimeter or other continuity checker.

We used plastic TO-3 transistor covers on both transistors. These are essential both to eliminate the possibility of short circuits and also to isolate the rather high voltages which are present on the case of Q4.

Q4 may either be a BUX80 as originally specified or a Motorola 2N6547. At pre-



The 150Ω, 220Ω and 2.7Ω resistors are all 1W units; the 0.22μF capacitor across the BUX80 (Q4) should be rated at 630VDC or 250VAC.

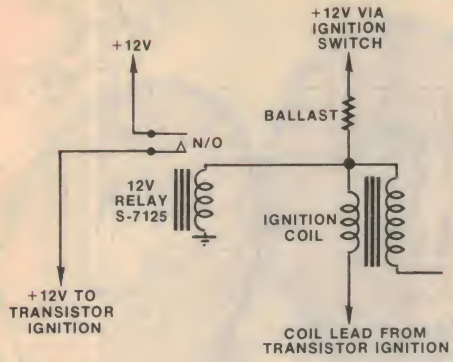
WHAT ABOUT CDI?

Incidentally, we debunked CDI systems in our December 1979 article because of a number of problems, chiefly circuit reliability, tendency to cross-fire and lack of compatibility with automotive tachometers. We no longer recommend any CDI design, including our own version described in July, 1975.

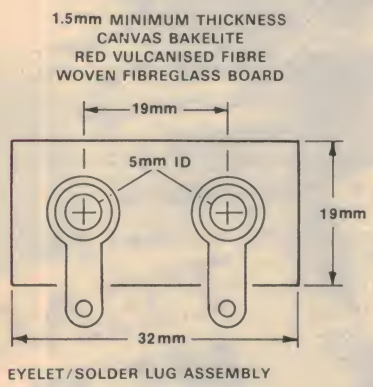
We stand by what we said then: that CDI is not suitable for four-stroke auto engines, particularly those that comply with pollution regulations. Not only will the cross-firing tendency of capacitor discharge ignition cause rough running but it is highly likely that it will cause damage to piston crowns. Nor is it likely to have any benefit for fuel economy as the very short spark duration is likely to result in less reliable fuel ignition.

It is significant that not one automobile manufacturer has incorporated CDI as standard equipment.

CDI does have a place in two-stroke engines where its ability to fire fouled plugs is an advantage and cross-firing is not a problem.



This circuit is suggested as a method of connection in cars with the ballast resistor in the wiring harness.



Use one of these lug assemblies to make the connections to the ignition system.

sent we know of no other transistors which are suitable equivalents so any other transistors which are substituted for Q4 should be regarded as bogus (unless the kitset supplier includes in the kit a note of authorisation from "Electronics Australia").

Now the components can be soldered onto the PC board. The only problems which might be encountered here are with the orientation of the diodes, the PUT and BD140 transistor, so pay special attention to the wiring diagram.

Note that the diodes should all be installed with a loop at one end, as shown in the photograph. The loop may be at either end although we have made it at the cathode end in each case.

Note that parallel combinations of resistors have been used in three instances. This is done because one watt resistors are cheaper and generally more readily available than equivalent five watt wirewound resistors and their temperature rise is not as great. Even so, one watt resistors can still become quite warm so mount them slightly off the board.

We suggest that you delete two of the three parallel 150Ω 1W resistors if you intend fitting the optional optoelectronic trigger circuit. This will reduce dissipation in the MJE340 trigger transistor, as well as lowering its "saturation" voltage.

Wires to the transistors and to the various external connections are heavy gauge 4mm auto cable. This won't fit easily into a standard PC hole so we suggest that you could either redrill the holes to an appropriate size or use PC stakes. If PC stakes are used make sure they fit tightly into the PC hole so they can't fall out when a wire is soldered onto them.

Mounting holes for the PC board should now be drilled. The PC board is mounted on the lid using brass or plated standoffs, screws, nuts and shake-proof washers. The holes will pass through both the lid and the heatsink, so ensure that the mounting screws don't interfere with the fins on the heatsink first. Before installing the PCB, wire up the leads to the power transistors. Use one-metre lengths of wire to provide the chassis, points, coil and battery connections to the PCB.

When the unit is actually installed these lengths may be increased or decreased and suitable lugs or connectors attached. The chassis cable is also connected to a lug on one of the standoffs so that the circuit is connected to the car chassis via the case as well.

Clamp the cables before they exit the box using a cable clamp; if necessary, build up the cable thickness with insulation tape to give a tight fit. The cable should exit via a grommetted hole on a

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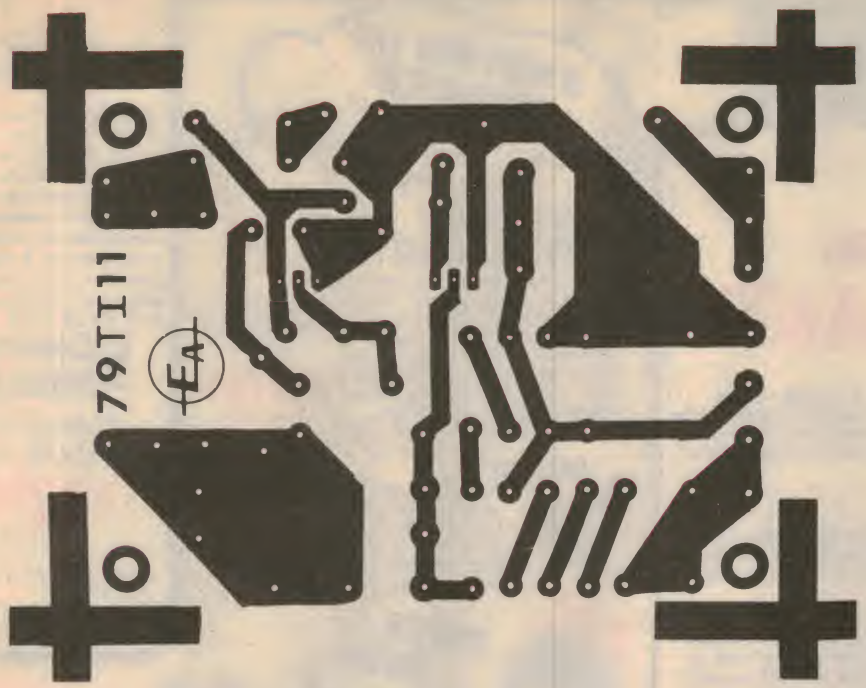

Actual size artwork for the PCB.

side of the box which will actually face downwards when installed. This will help keep water out of the unit.

The only remaining task is to install the completed unit into the car. For reliable performance of the unit choose a well-ventilated spot – ideally well away from possible splashing by mud or water. Near the front grille or on the wheel housing would be suitable positions.

Install the case by the use of a suitable bracket or drill several holes in the bottom of the case and secure it to the vehicle by means of 12mm×No. 10 self-tapping screws. With the unit mounted, the various connections to the car electrical system can be made.

For this purpose, we recommend the use of an eyelet/solder lug assembly. This sits on what is normally the points connection of the coil but which now is connected to the collector of Q4. The remaining connection point of the solder lug assembly connects the points wire from the distributor back to the "To points" lead in the transistor ignition.

The other connection to the coil remains as standard because it is the same whether transistor or conventional ignition is being used. In this way it is simply a matter of swapping leads to the eyelet assembly on one side of the coil, if a changeover is necessary. We do not recommend any other system of changeover which may involve switches or plugs.

Most kitset suppliers already supply this eyelet as standard.

Apart from the connections to the ignition coil and points it is also necessary to connect the +12 volt lead to the battery via the ignition switch. Some circuit designs actually obtain power via the ballast resistor, which means that the circuit would probably be easier to install but it also has the disadvantage of reducing coil current and so reducing spark energy.

If your car has a separate ballast resistor then it is a simple matter to connect to the ignition switch side of the resistor. Some cars, though, use a ballast wire, which complicates the situation because it is then necessary to guide the +12 volt lead from the transistor ignition through an appropriate hole in the firewall to the actual ignition switch itself. Alternatively, if you do not wish to drill through the firewall then you can use the circuit shown elsewhere in this article. It consists simply of a relay connected to the coil side of the ballast resistor which switches the +12 volt from the battery directly. The relay can be installed inside the box.

With installation complete, the system can be tested. The points gap should be set exactly as specified by the car manufacturer. Note that if a "dwell meter" is used to set the points gap, then it is probably best to do this adjustment when the vehicle is running with conventional ignition.

Parts List

1 PC board, code 79ti11, 91mm×68mm
1 diecast aluminium box, 118×93×56mm, Eddystone 6908P or similar.
1 dual TO-3 heatsink (see text)
3 metres red 4mm auto cable
1 metre black 4mm auto cable
4 25mm brass standoffs
2 sets of TO-3 mounting hardware, ie, mica washers, insulating bushes, screws and nuts.
2 TO-3 transistor insulating caps
1 eyelet/lug assembly

SEMICONDUCTORS
1 BUX80, 2N6547 transistor
1 2N3055 transistor
1 BD139 transistor
1 2N6027 PUT
5 1N4002 diodes
3 1N4761 75V zener diodes

CAPACITORS
1 0.22µF 630VW or 250VAC
3 0.1µF metallised polyester (greencap)

RESISTORS (¼W or ½W unless specified)
2×15kΩ, 3×1kΩ, 1×560Ω, 1×220Ω, 2×220Ω/1W, 3×150Ω/1W, 1×10Ω, 3×2.7Ω/1W.

ADDITIONAL PARTS FOR OPTO-ELECTRONIC TRIGGER OPTION
1 printed circuit board set, code 81ti6, 74×58mm
1 5401 quad two-input NAND gate (do not substitute)
2 MJE340 NPN transistors
1 TIL81 phototransistor
1 TIL31 infrared LED
1 5.6V 400mW zener diode
4 1kΩ resistors (¼ or ½ watt)
1 680Ω resistor (¼ or ½ watt)
1 470Ω resistor (¼ or ½ watt)
1 39Ω resistor (½ watt)
2 brass pillars
Machine screws and nuts, cable clip, two-core cable etc.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.

Turn to page 56 for optoelectronic trigger system

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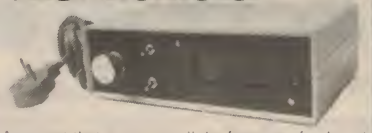

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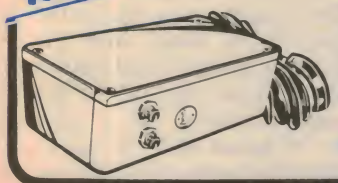

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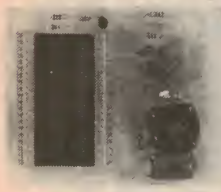

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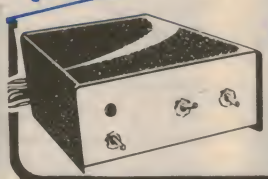

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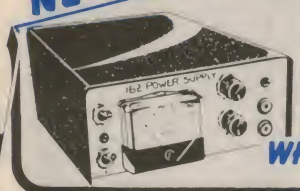

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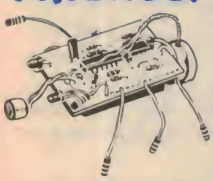

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Optoelectronic trigger locks in engine tune

If you want to convert your car's ignition to a breakerless system, here's how you do it. This optoelectronic trigger circuit provides an output which simulates the mechanical contact breaker (or points), and can trigger the EA Transistor-Assisted Ignition System without modification. The existing centrifugal and vacuum advance mechanisms are retained, and the only mechanical part which must be constructed with any precision is a chopper disc.

Main advantages of the system are that it locks in engine tune and is maintenance free. The engine remains at peak tune, and there is no need for periodic adjustment of the points gap and timing to compensate for contact heel wear. There is a disadvantage though: once the points are eliminated it is no longer possible to quickly revert to a conventional system in the event of a malfunction.

The light source is an infrared LED (TIL31) with a lens to give a well defined beam which is received by phototransistor Q3 (TIL81). Light passing between the two is interrupted by a chopper disc which produces a rough square wave.

This waveform is cleaned up using an open collector TTL IC with two gates, IC1a and IC1b, connected as a set-reset bistable. The inputs are driven in complementary mode by using a third gate, IC1c, as an inverter, while the remaining gate (IC1d) is used as a buffer and drives trigger transistor Q2.

Power for the circuit is derived from the vehicle ignition system. A regulated +5V rail is derived using series regulator transistor Q1 and associated zener diode D1.

Construction

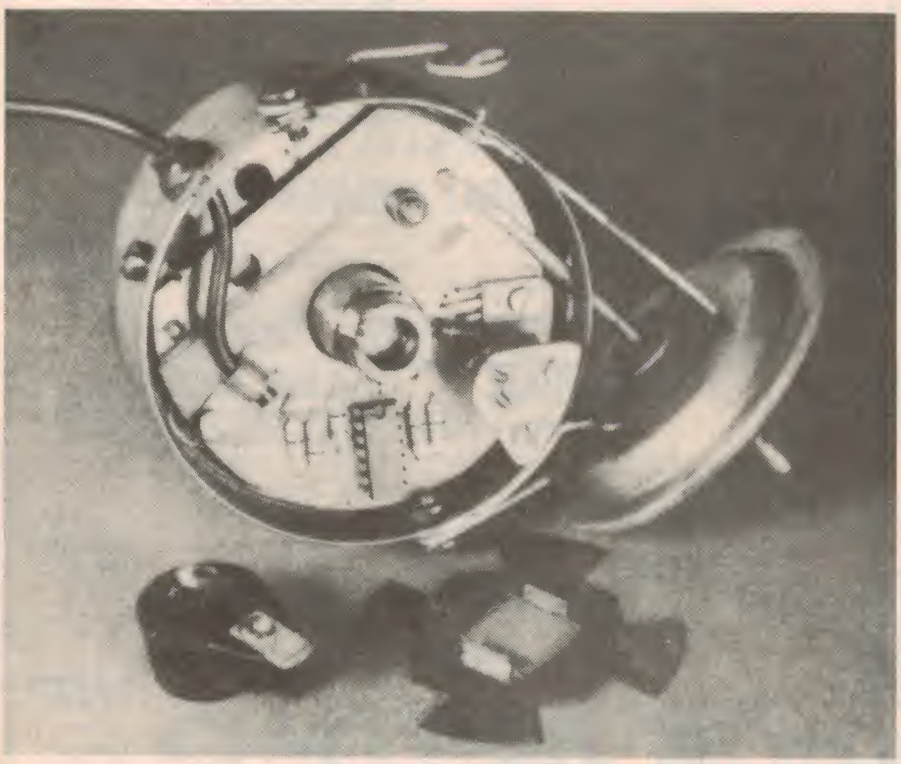
The complete circuit can be built on a glassfibre PCB and mounted inside the distributor. The prototype fits a Delco distributor as fitted to many GM vehicles, but the layout can be modified to fit most other types. Some foreign vehicles use very small distributors, and for these it is best to house the circuit in a small metal box beside the distributor.

The phototransistor is mounted directly on the PCB and the LED is mounted about 2.5mm away on a small board supported by 3mm tapped pillars which also carry the LED current. The main PCB is mounted with spacers on the action plate in the distributor with 3mm screws which must have holes drilled and tapped. As the action plate is rotated by the vacuum advance mechanism, it must not be obstructed by the board or swarf, and the manufacturer's recommended lubricant should be restored. If the existing contact pivots on a pillar rivetted to the action plate, the pillars must be removed before the PCB can be installed.

Care must be taken to ensure that the small board does not foul the rotor arm or the inside of the distributor cap. When installed, the PCB is connected to the ignition unit by a length of good quality miniature two core stranded cable. The cable should be supported by a small P clip fixed by one of the mounting screws, and by the existing grommet in the distributor body. Remember to leave enough cable loose so that the action plate can revolve.

The circuit can be tested by connecting +12V to the supply lead, and a low power bulb from +12V to the output lead. The lamp should remain on until the light beam is interrupted. If the circuit switches the lamp correctly, connect it to the electronic ignition unit and take the high tension (HT) lead from the coil directly to one spark plug. This will avoid coil breakdown if the rotor arm is not pointing at a segment of the distributor cap. Check that a spark is generated every time the light beam is interrupted.

When the circuit has been tested, a chopper disc should be constructed to suit the distributor. The accuracy of this disc affects the overall performance of the system, and the most important parameter is the angle between the leading edge of the blade and the line joining the mainshaft axis with the centre of the rotor arm sector. It is imperative that



This view shows the assembled PCB mounted on the action plate of the distributor. In the prototype, Q1 was mounted underneath the board. Make sure that the emitter of Q2 is earthed via its mounting screw.

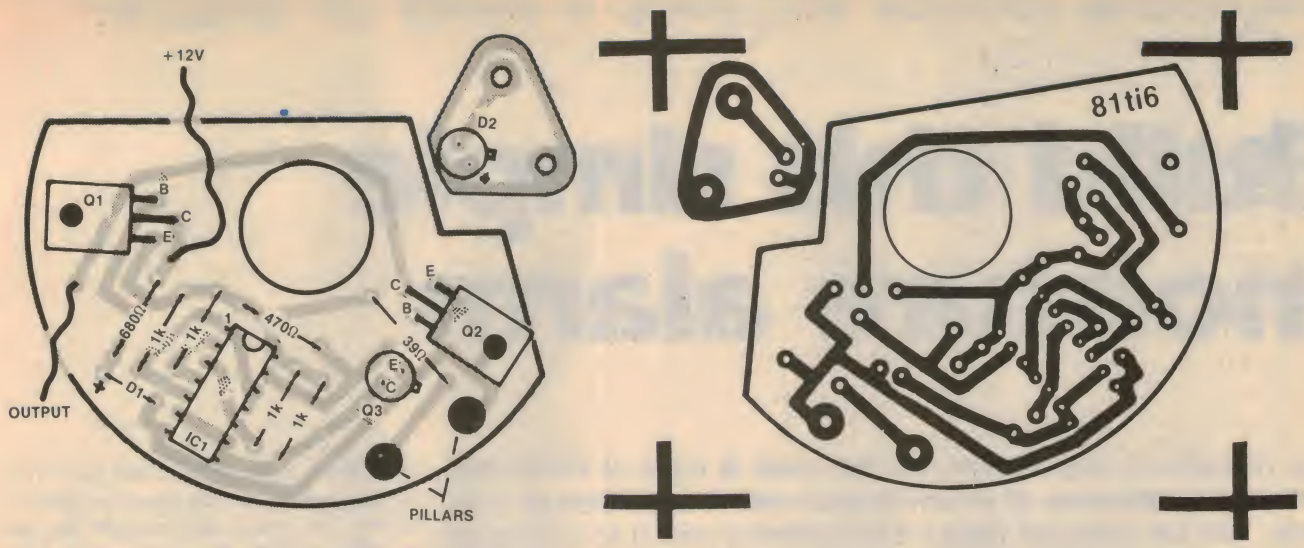
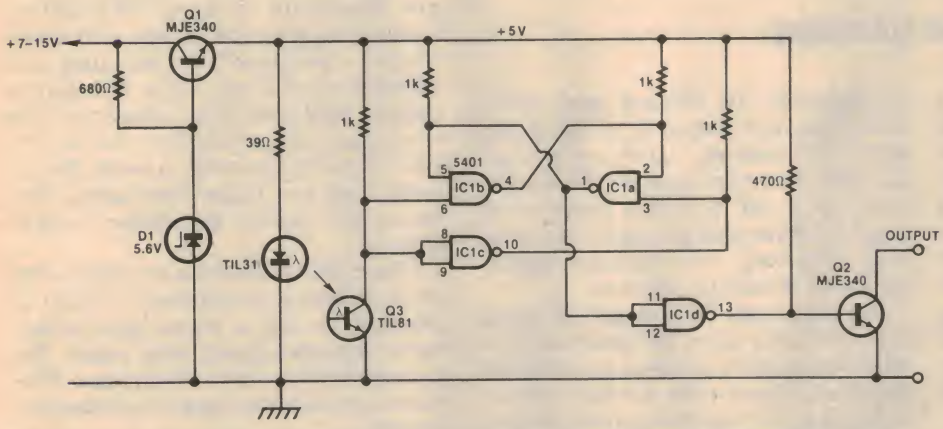
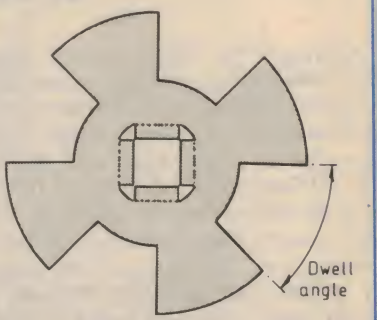


Fig. 1: Parts overlay and actual size PCB pattern. Q1 and Q2 do not require heatsinks, but should be secured with the screws that hold the PCB in place. The mounting screw that secures Q2 also provides the chassis return for the earth track on the PCB.





IC1 cleans up the waveform produced by phototransistor Q3 and drives trigger transistor Q2. Regulator transistor Q1 is used to derive the +5V rail.

this angle causes the leading edge of a blade to just obscure the LED, ie the point of firing, when the end of the rotor arm is directly opposite a segment inside the distributor cap, with the vacuum advance at mid-travel. If this condition is not achieved the engine may not run.

Another important requirement is that the chopper blades are evenly spaced to avoid scatter. The angle between the blades is found by dividing 360° by the number of cylinders. Although this unit is suitable for any number of cylinders, the greatest improvement will be noticed on engines with six cylinders and above, where multi-lobed cams cause more timing scatter.

The disc does not need great strength, and the prototype was cut from tinplate. The centre hole has tabs which are alternately bent up and down to grip the cam as shown in Fig. 2. To construct the disc make a centre punch mark and scribe a straight line through the centre mark. Using a large transparent circular protractor with 0 and 180° marks on the line, mark the position of the blade edges and scribe lines to the centre. The width of the chopper segments is not important since the TAI unit has in-built dwell extension.

Cutting the disc shape is made easier if the tinplate is clamped to a thin sheet of aluminium or plywood. After drilling the centre hole and filing it to shape, cut the disc to the correct diameter, cut the blades to shape and finish with a fine file. Finally, bend the tabs for a good central fit on the cam.

The disc is then fixed to the cam with epoxy resin after checking that all the parameters are correct and that the disc revolves freely. When installation is complete, the distributor can be mounted in the engine and adjusted for correct timing with a strobe light.

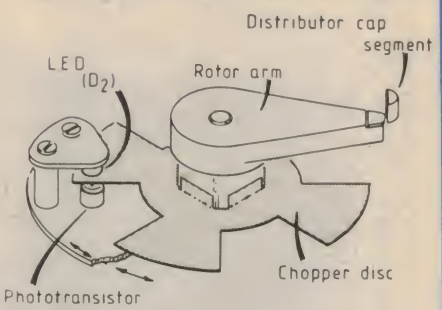


Fig. 2: Typical shape and mounting details for the chopper disc. It is imperative that when the disc just interrupts the light beam, the rotor arm is directly opposite a distributor segment with the vacuum advance at mid-travel.

Note: This optoelectronic trigger system originally appeared in "Wireless World", April 1981, and was reprinted in our June 1981 issue. It is reprinted here with minor circuit modifications to make it compatible with our TAI system.

Versatile circuit triggers a relay or buzzer

Build this simple moisture alarm

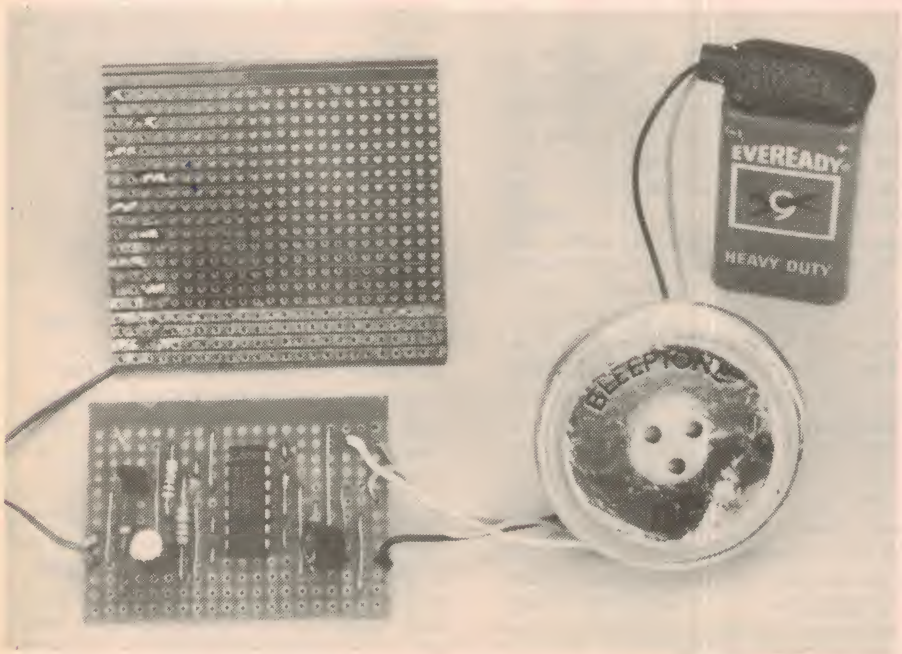
This versatile moisture alarm can be used to warn of either the presence or absence of moisture and, with the addition of one diode, can be changed from a self-resetting circuit to a manual reset. Once triggered, a piezoelectric buzzer emits a series of loud "pips" which should prove quite effective in attracting attention. Alternatively, the circuit can be used to trigger a relay.

by COLIN DAWSON

Although the basic circuit uses a piezoelectric buzzer, this could easily be replaced with a LED or buffer transistor and relay. There are numerous applications for such a device, such as saving the washing from a downpour by sounding the alert when the rain starts. Other applications might include a basement flood alarm, bathtub overflow warning, or a bed wetting alarm. Perhaps you could even use it as a novel doorbell – all the caller has to do is place his finger on the sensor board.

The sensitivity of the alarm can easily be altered to suit different applications. With maximum sensitivity, it will be triggered by breathing heavily on the sensor. Such a mist detector may have some uses but it will generally prove much more sensitive than necessary. To avoid false triggering, the minimum usable sensitivity should be selected.

The circuit can be arranged to sound the alarm only while the abnormal condition exists, or to continue sounding the alarm until the circuit is reset. This second mode of operation would be particularly useful as a "monitor" function whereby it is possible to tell that an abnormal condition has occurred after the event. This could, for example, be used to indicate that a livestock or pet watering system has been empty at some stage.



The moisture alarm is built on a small piece of strip board, while a second piece of strip board is used as the sensor. Power is derived from a 9V battery.

The sensor we have used with the moisture alarm is simply a piece of copper strip board of about 55 x 60mm. Rather than wire the sensor so that the tracks on the board form two grids with adjacent tracks, we have included a neutral third grid. The purpose of this third grid is to physically separate the two "active" grids so that a small drop of water can not trigger the alarm. This makes the device less prone to false alarms.

If the circuit is intended to monitor the level of water in a container, it would be practical to use a probe type sensor rather than the copper strip board. This would simply involve placing two electrodes about 10mm apart in a protective sheath.

The circuit is ideally suited to battery power, having a very low current drain. This is due to the fact that IC1 – a low power CMOS type – is the only part of the circuit which normally uses any power. The use of a piezoelectric transducer ensures that even when triggered, the alarm has a quite modest current drain.

More specifically, the current drain before triggering is typically a mere 0.5μA – a tribute to the CMOS device – and, even when triggered, it is only about 2.5mA. In these circumstances the battery life would typically be limited more by shelf life than current drain.

Circuit Description

IC1 is a 4093 quad two input NAND gate. A NAND gate is a device whose output is low only when all of its inputs are high. Any other combination of inputs result in a high output. By tying the inputs together, the gate can be made to operate as an inverter, ie, its output is in the opposite logic state to its input. The 4093 differs from the more common (and slightly cheaper) 4011 quad NAND

in that it has Schmitt trigger action on its inputs and it is this feature which makes possible the single IC design.

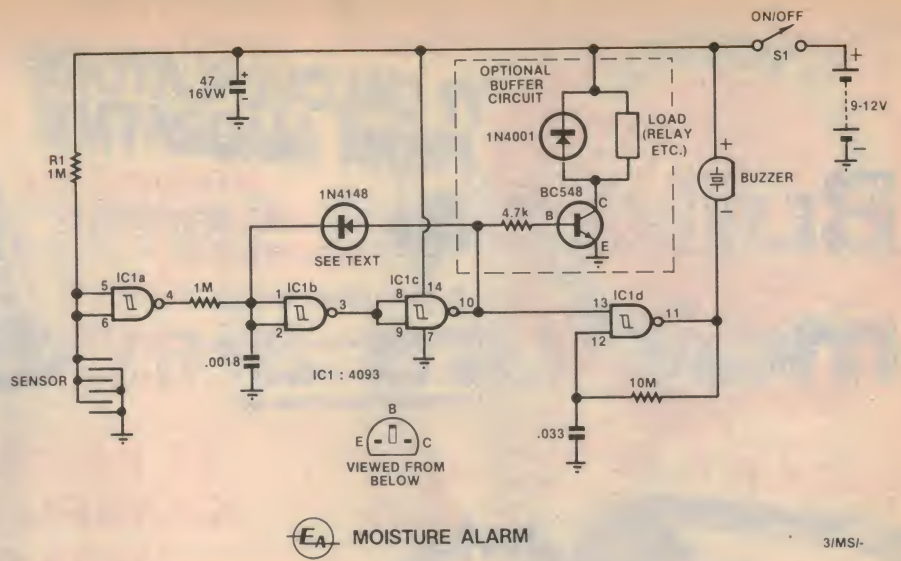
A Schmitt trigger is basically a device which has hysteresis, ie, its upper and lower thresholds occur at different voltages. The normal gate sees all input voltages above a certain level as logic 1 and all voltages below this level as logic 0. For input voltages in the vicinity of the critical level, only very small changes are needed to trigger a change in the output state. With a Schmitt trigger, however, there are two critical input voltages – an upper and a lower. These are typically about 2V apart for the 4093, for a 9V supply.

The moisture alarm circuit can be considered as having two main parts – a trigger and an oscillator. The type of buzzer specified for this project need only be connected to a DC power supply of between 6 and 20V in order to operate. However, it is much more effective when modulated, and this is the purpose of the oscillator.

The Schmitt trigger characteristic is used to advantage in both the detection and oscillator parts of the circuit. Hysteresis has a fairly obvious advantage as far as the detection is concerned – it ensures "clean" triggering at the critical level. With respect to the oscillator, the advantage is that it makes possible a single gate oscillator, whereas three would otherwise be required. This leaves two gates spare for the manual resetting option.

IC1a serves as the detector. Its inputs (pins 5 and 6) are connected together and normally held high by a 1MΩ resistor. Because IC1a functions as an inverter, its output (pin 4) is normally low. The moisture sensing probe is connected between pins 5 and 6 and ground but is normally open circuit (more correctly, its resistance is in the order of tens of megohms or higher). As soon as the sensor contacts water its resistance drops and pulls pins 5 and 6 low. This represents a triggered state, with the output of IC1a going high.

When wired in this mode, the alarm warns of the presence of water, ie, as a flood or rain indicator. By reversing the connections of the 1MΩ resistor and the sensor (ie, resistor to ground and sensor to positive), the alarm will have the opposite sense. It could then be used to warn of low water level for households dependent on tank water or even for your car's windscreen washer. If the 1MΩ resistor is replaced with a lower value, the sensitivity will be reduced by a corresponding amount.



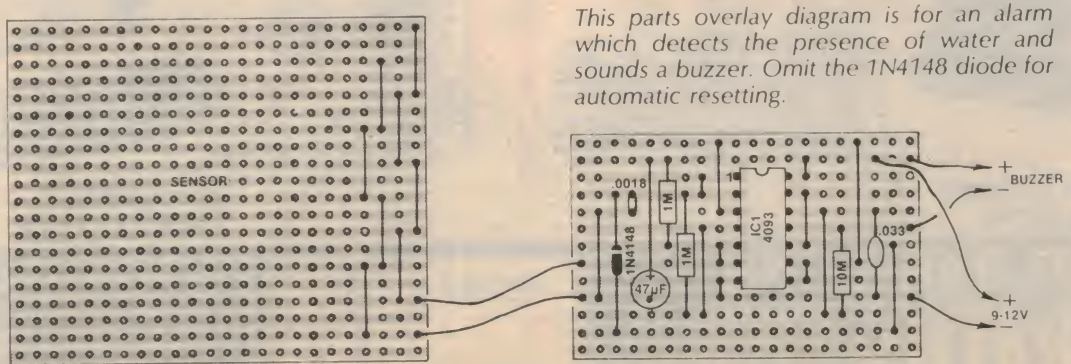
The circuit has two main sections: a trigger circuit consisting of IC1a,b&c, and oscillator IC1d. Also shown is the optional relay driver circuit.

IC1b and c are wired as inverters, with the output of IC1b (pin 3) driving the input of IC1c (pins 8 and 9). The input of IC1b is driven by the output of the detector (pin 4) via a 1MΩ resistor. In normal operation, this resistor has no effect on the circuit. The same logic state exists on the outputs of IC1a and IC1c. This may sound like a rather pointless exercise, but it contributes greatly to the versatility of the circuit.

When the circuit is required to operate in the manual resetting mode, IC1b and 1c function as a latch. A 1N4148 diode is connected from the output of IC1c (pin 10) to the input of IC1b. As soon as the trigger condition occurs, pin 10 goes high and the diode causes pins 1 and 2 to be pulled high. The 1MΩ resistor isolates the outputs of IC1a and 1c so that they are not opposing each other, thereby facilitating the latch function. To reset this circuit simply switch off for two or three seconds. If manual reset is not required the 1N4148 diode is omitted.

IC1d is used to drive the buzzer, with one of its inputs (pin 13) used as a control. Normally, pin 13 is low and the output (pin 11) high. Because the buzzer is connected between pin 11 and the positive supply line, it is effectively disabled when pin 11 is high. When an alarm condition is detected, pin 13 is taken high and pin 11 goes low.

While pin 11 is high and the buzzer is disabled, the 0.033μF capacitor is charged via the 10MΩ resistor, taking pin 12 high. When pin 11 goes low the buzzer sounds and the capacitor begins to discharge through the 10MΩ resistor. After about 0.5s the capacitor charge, and the voltage on pin 12, falls below the lower threshold voltage of IC1d. This toggles the gate, its output goes high, and the capacitor begins to charge. After another 0.5s pin 12 reaches the upper threshold voltage and the gate toggles again. In this way the hysteresis of the Schmitt trigger makes possible a single gate oscillator. Otherwise it would have been necessary to use three conventional NAND gate inverters to make such an oscillator.



This parts overlay diagram is for an alarm which detects the presence of water and sounds a buzzer. Omit the 1N4148 diode for automatic resetting.

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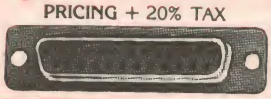

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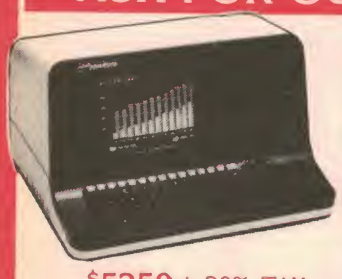

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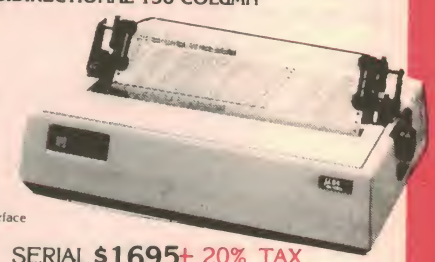

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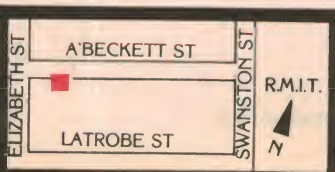

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The 0.5s switching sequence drives the buzzer in a series of pips, but could just as easily drive a LED or other suitable load. If it is desired to drive a load continuously, the output should be taken from pin 10. This will be high when triggered. To drive loads of greater than 10mA, a transistor buffer can be used. This consists of an NPN transistor (such as a BC548) whose base is driven via a 4.7kΩ limiting resistor from pin 10. Any suitable load – such as a relay – can be connected between the collector of the transistor and the positive supply rail. A 1N4001 diode across the load protects the circuit against "kickback" voltages which will occur with inductive loads.

Construction

In recent years, we have used printed circuit boards almost universally for our projects but, with the rain alarm, it is quite feasible to use copper strip board (such as Veroboard). With several possible variations of the basic circuit, the strip board layout can be easily altered to suit. Although strip board construction can be rather tedious for larger projects, it is ideally suited to smaller projects like the moisture alarm. It is preferable to use plated strip board, at least for the sensor, as it will resist tarnishing.

The circuit presented in the accompanying overlay diagram is for an alarm which triggers on the presence of water and sounds a buzzer. It can be wired for either automatic or manual resetting. Any other circuit configuration will require a different layout, but it is not practical for us to provide an overlay for all possibilities.

The parts list for the moisture alarm calls for a piece of copper strip board measuring approximately 60 x 95mm. This will need to be cut into two smaller pieces – one on which to mount the components and the other for the sensor. The sensor is the larger of the two, measuring 55 x 60mm, so constructors using a different type of sensor will need only the 38 x 60mm board (our prototype was a shade smaller, but did not allow much room for modifications).

Before mounting any components on the board, cut the appropriate tracks. This can be done by drilling the holes (on the foil side of the board) where the track is to be cut. A drill of about 5mm, rotated between the fingers, will perform this function. Alternatively, you could simply cut the tracks with a blade, but make certain that you achieve an "open circuit".

Install the links first. If you don't have any tinned copper wire on hand, trimmed-off component leads can be used. Follow the overlay diagram for the positioning of the links. The resistors, diode (where applicable) and capacitors can now be installed.

The last component to be mounted on the board should be the IC. As this is a CMOS type, it can be damaged by static electricity. For this reason, you should connect the barrel of the soldering iron to the earth track of the board whilst soldering the IC.

The actual moisture sensor used is optional but the type shown in the overlay diagram should prove suitable for most applications. Obviously, this sensor will be located remotely from the rest of the circuit, but the distance is not critical. The rest of the components, including battery, will fit into a plastic utility box measuring 40 x 67 x 130mm. A smaller box can be used if the buzzer is to be mounted externally.

For a preliminary test of the project, it is not necessary to actually wet the sensor. Just short the two "active" lines together and the buzzer should sound. If all is well, dip the sensor in some water and the alarm should sound. Note that for manually resetting versions, the circuit must be switched off for a few seconds between each test. If your version of the alarm is particularly sensitive, it will also be necessary to dry the sensor between tests. That's about it for testing – your moisture alarm is now ready to enter service.

PARTS LIST

1 4093 quad NAND Schmitt trigger
1 1N4148 diode (see text)
1 Piezoelectric buzzer
1 47µF/16V electrolytic capacitor
1 .033µF greencap
1 .0018µF greencap
1 Copper strip board (tinned), approx 65 x 95mm
1 9V battery (Eveready 216 or equivalent)
1 Battery snap to suit
1 10MΩ (¼W, 10%) resistor
2 1MΩ (¼W, 10%) resistor

RELAY OPTION
1 BC548 NPN transistor
1 1N4001 silicon diode
1 12V relay with coil resistance of 200Ω or more
1 4.7kΩ/¼W or ½W resistor

PRICE ESTIMATE
We estimate that the current cost of components for this project is approximately $12.00. This includes sales tax but not the cost of a battery.

SO PURE, IT'S WICKED

The ETI 5000 System. Pristine. Pure. Cocaine for the ears.
And to think that they are Australian made and designed. They can stand comparison with any kit or ready-built available — anywhere. In fact we still think that they are the world's best amplifiers. We should be justifiably proud of this achievement in Audio.

"BLACK MONOLITH"

REF: ETI JAN/MARCH 1981

$319

SPECIFICATIONS

POWER OUTPUT	Around 100W RMS into 8 ohms
FREQUENCY RESPONSE	8Hz to 20kHz, +0 — 0,4dB 2,8Hz to 65kHz, +0 — 3dB Note: these figures are determined soley by passive filters
INPUT SENSITIVITY	1V RMS for 100W output
HUM	— 100dB below full output (flat)
NOISE	— 116dB below full output (flat, 20kHz bandwidth)
2nd HARMONIC DISTORTION	<0,001% at 1kHz (0,0007% on prototypes) at 100W output using a ±56V supply rated at 4A continuous
3rd HARMONIC DISTORTION	<0,003% at 10kHz and 100W
TOTAL HARMONIC DISTORTION	<0,0003% for all frequencies less than 10kHz and all powers below clipping Determined by 2nd harmonic distortion (see above)
INTERMODULATION DISTORTION	<0,003% at 100W (50Hz and 7kHz mixed 4;1)
STABILITY	Unconditional

We regret to advise that among other things, metal-work and sales tax increases have forced us to increase our prices slightly. Whilst we could have kept our costs down by using inferior components, we refused to take this course of action

The ultimate Hi Fi power amplifier. We call our model the "Black Monolith" because we feel that the name symbolises the intelligence that went into the design.
The Jaycar "Black Monolith" is without doubt the best kit of the project available. If you have doubts ring our Managing Director, Gary Johnston and he will tell you! (Be prepared for a long conversation).
Several kit suppliers now have 'versions' of the original 5000 P.A. which claim to be similar to ours. This is simply not the case.
Space does not allow us to show EVERY refinement that has been made to the 5000 but notable ones are:

EXCLUSIVE FEATURES:
- Rear panel mains fuseholder
- 1% METAL FILM resistors used
- Flux shorting strap on power transformers
- Original chassis bar design
- Beryllium Oxide (Space Age Ceramic) TO 3 washers. (NOT flimsy Mica)
- Jig drilled and extruded heavy gauge, anodised heatsink bracket
- SUPERFINISH front panel. STILL THE BEST now with blind tapped holes
- New heavy duty heatsinks for the driver transistors. 100% extra heatsink area and black anodised for greater efficiency (NOT in original design)
- Ventilation holes in metalwork at critical points (NOT in original design)
- Extra 3 pin DIN socket on rear panel (total 2) to power new 5000 components

IF YOU THINK THAT YOU CAN SAVE MONEY ON THESE KITS ASK YOUR SUPPLIER IF HE WILL GIVE YOU ALL OF THESE FEATURES AT THE PRICE. MAKE SURE THAT YOU GET IT IN WRITING!! (Write for new glossy leaflet (SAE))

5000 SERIES GRAPHIC EQUALISERS

$299

latest addition to the thoroughbred 5000 Series stable! David Tillbrook has once again produced a 'No Compromise' design. This new component, a 1/3 octave equaliser, gives you ABSOLUTE CONTROL over the acoustics of your particular listening enviroment. You get 3 SEPARATE CONTROLS for every octave of audio bandwidth to virtually eliminate the subtle nuances that are particular to your listening area.
1/3 octave equalisers have been used by professional engineers in Recording Studios and Live Concerts for over a decade now. It is no accident that the advent of the 1/3 octave equaliser and studio quality live sound have gone hand in hand. BUT THERE'S A CATCH. One of these equalisers is not enough. You will have to buy 2 (for stereo). Quite a lot of money — but worth it if you want the best. The Jaycar kit includes a fully pre-punched plated chassis, pre-punched heavy gauge front panel with silkscreened front panel to match the other 5000 components. It is absolutely original. You can purchase the kits one at a time for $199 each or for two, $389 — a $10 saving. If you are one of the hundreds of happy 5000 users we are convinced that you will be just delighted with this unit.

SPECIFICATIONS:
Signal-to-Noise: —102dB with respect to 1 Volt
Frequency Response: 12Hz — 105kHz to —1dB
Boost/Cut: 14dB (28dB total)
Distortion: 100Hz-0.007%
1kHz-0.007%
10kHz-0.008%
(essentially irrepective of cut or boost)
Current consumption (DC) Approx 100mA @ ±15V (Requires 30V AC CT)
Output short-circuit proof.

$179 EACH

NEW LOW PRICE!!!
BUY 2 FOR $350

AUSTRALIAN (NOT HONG KONG) MADE — SPECIAL BUILT RACK CABINET — QUALITY!!!

ALL IC SOCKETS PROVIDED

"BLUEPRINT"

"One Swallow does not make a spring"
— Neither does a few gold RCA sockets!
Several of our competitors are imitating our "Blueprint" preamp by adding a few bits and pieces, notably gold plated RCA sockets to their standard kits. Unfortunately they have missed the point. We supply gold plated sockets in our "Blueprint" preamp but only where it makes sense to do this, i.e. on the inputs — NOT the outputs. 16 gold sockets are provided by us. This, however, does not make a "Blueprint". THIS DOES:
- Low capacitance screened cable — 12 metres of it. NOT Taiwanese cable as supplied in other kits. Our cable costs us NEARLY 5 TIMES MORE than the Taiwanese stuff.
- Original ETI designed front panel. Not an "ADAPTION". Our front panel is by far the nicest.
- Factory pre-tinned PCB's to reduce chances of dry or noisy solder joints.
- Quality LEDs, polished finish, multicoloured display.
- IC sockets on line amp board.
- Special rear panel.
- Special low noise selection LM394H NOT CH device in M.C. preamp.
- Thermalloy (U.S. made) heatsink on 7805 regulator.
- English Lorlin selector switches.
- Apart from the 16 gold RCA's we throw in a pair of gold plated line RCA plugs — worth $5.
- Special Nylon rear panel grommets.

So don't "Swallow" the facts before they are properly digested!!
You can't make a silk purse out of a sow's ear. Send SAE for full specs.

SPECIFICATIONS

Frequency Response	High level input: 15Hz-130kHz +0, —1dB Low level input: conforms to RIAA equalisation +0.2dB (see details on Phono specs)
Distortion	1kHz 0.003% on all inputs (limit of resolution on our measuring equipment due to negligible distortion)
S/N noise	High level input master full with respect to 300mV input signal at full output (1.2V): —92dB flat, —100dB A weighted MM input master full with respect to full output (1.2V) at 5mV input 500 ohm source resistance connected: —86dB flat, —92dB A weighted MC input master full with respect to full output (1.2V) and 200uV input signal: —71dB flat, —75dB A weighted

ETI 478MM MOVING MAGNET INPUT STAGE

Gain	74 1kHz
Frequency Response	Conforms to RIAA Equalisation +0.2dB
Total Harmonic Distortion	0.001% 1kHz 10mV RMS input
Headroom	+28dB with respect to 5mV RMS input signal i.e. 135mV RMS
Noise	Total equivalent input noise 122nV A input shorted 216nV flat input shorted

S/N ratio	1mV	5mV	10mV
Flat	73dB	87dB	93dB
A weighted	78dB	92dB	98dB

ETI 478MC MOVING COIL INPUT STAGE

Gain	24
Frequency Response	7Hz — 135kHz +0 —1dB
Total Harmonic Distortion	0.003% 1kHz 30mV input
Noise	Total equivalent input noise 83nV flat input shorted 42nV A input shorted 56nV flat after RIAA EQ (flat shorted) 34nV A after RIAA EQ (input shorted)

FUNCTIONS
- MOVING COIL INPUT
- MOVING MAGNET (DYNAMIC CART)
- INPUTS (2 OFF)
- TUNER INPUT
- AUX INPUTS (2 OFF)
- TAPE INPUTS (2 OFF)
- INPUT LEVEL CONTROL
- TAPE OUTPUTS (2 OFF)
- 400Hz CALIBRATION OSCILLATOR
- LED AVERAGE (VU) & PEAK
- LEVEL METERS —48dB TO +9dB
- MODE SWITCH, STEREO BALANCE CONTROL, LINE OUT, MONITOR OUT, MONITOR VOLUME CONTROL

FEATURES
- EXTREMELY CLOSE TRACKING TO RIAA PHONO EQ
- GOLD PLATED CONNECTORS ON ALL INPUTS
- ENGLISH 'LORLIN' LOW NOISE SELECTOR SWITCHES
- LOW NOISE 1% 50ppm METAL FILM RESISTORS USED
- TINNED FIBREGLASS PCB's
- LOW CAPACITANCE SCREENED CABLE USED THROUGHOUT
- QUALITY I.C. SOCKETS
- SPECIAL REAR PANEL
- MULTICOLOURED RECTANGULAR LEDs USED

COMPLETELY BUILT AND TESTED – NOT A KIT!!

AS REVIEWED IN EA OCT. 1982 and ETI NOV. 1982

CONTAINS EQUIVALENT OF THOUSANDS OF TRANSISTORS – USES MASSIVE CUSTOM LSI CHIP TO ACHIEVE LOW PRICE

IDEAL RALLY COMPUTER!

only $199 complete

THE BEST CAR COMPUTER BELOW $200

Never before has such a comprehensive car performance computer been offered at such a low price!! Once again miracle microprocessor technology has enabled us to pass enormous savings on to you!!
But don't let the low cost fool you. The "Voyager" car computer IS THE MOST COMPREHENSIVE PRODUCT THAT WE HAVE SEEN. No other car computer matches this one AT EVEN TWICE THE PRICE! You could buy a $20,000 Holden and not get a better car computer!!
Just check the features. We are sure that you will calculate that the "Voyager" represents outstanding value!

FEATURES

- INSTANT FUEL CONSUMPTION IN LITRES/100KM AND MPG!! (MOST OTHERS HAVE ONLY ONE OF THE ABOVE) JUST SWITCH FROM ONE TO THE OTHER AS YOU DRIVE ALONG.
- INSTANT SPEED, TIME AND OTHER FUEL DATA.
- VISUAL AND AUDIBLE EXCESS SPEED ALARM.

INSTALLATION

The "Voyager" comes complete with an unbelievable array of mounting configurations, on dash, under dash or stalk mount. ALL installation hardware is supplied (even a roll of insulation tape!) as well, of course, as the speed and fuel sensors. A lavishly illustrated installation manual is provided as well as a comprehensive operators manual.

AVAILABLE FROM: ROD IRVING MELBOURNE, ALTRONICS PERTH, TOMORROW'S ELECTRONICS GOSFORD 247246

8 CHANNEL MIXER KIT

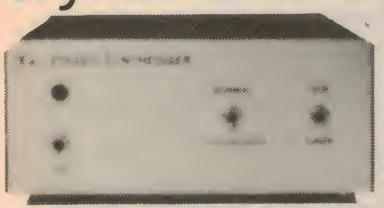
GREAT VALUE FOR MONEY

The Jaycar 8002 Mixer was originally conceived to be the successor to the very popular ETI414 Master Mixer. The 414 was basically configured as a 'stage' mixer and suffered from a number of severe technical limitations – notably poor signal-to-noise figures. Enormous advances in Audio IC's have occurred since the 414 was designed. Jaycar engineers have taken advantage of this. The incredibly low noise and distortion figures of the 8002 are a testimony to the sound basic design of the mixer coupled with the performance capability of these IC's. Whilst the 8002 is the ideal 8 channel compact stage mixer, other applications have been kept in mind.
AS A "STUDIO" MIXER. The prime requirement of a studio mixer is that it must be quiet – i.e. have good S/N. Due to the fact that the "miracle" 5534 IC's are used in the 8002 studio applications are entirely feasible. In addition to this, metal film resistors are used in critical signal areas.
AS A DISCO MIXER. The balanced input feature of the 8002 is not really necessary for disco use. This section can easily be bypassed with either a moving magnet (Dynamic Cartridge) preamp, or a moving coil preamp The sensible format of the 8002 and tremendous equalization facilities should make this mixer popular for disco use.

FROM $495

- Balanced (600 Ohm) Mic. Inputs/Line Inputs.
- Cannon Connectors included in the price.
- Bass, Mid & Treble Equalization on each Input.
- "Effects" (i.e. Echo etc.) capability.
- Foldback and Stereo Pan on ALL 8 Inputs.
- 60mm Slide Faders used throughout.
- 19" Rack Mount capability (or Console Mount).
- Professional Black Front Panel with Format borders & multi coloured knobs to assist function identification.
- VU Metering.

STEREO Synthesiser *



from $39.50

One of the most effective projects that we have seen. Creates an extremely realistic stereo effect from any line level mono signal! The effect on your signal is staggering. The audio track on your VCR comes to life! Just like the movies! You can convert your T.V., AM tuner or anything now to wall-to-wall stereo sound. Jaycar has two versions of this kit; a short form which enables you to build the synthesiser inside other equipment and the full free standing unit.
SHORT FORM kit contains PCB and all electronics associated with board but not power transformer or case $39.50
FULL KIT contains everything including power transformer and case $49.50
Ref: EA September 1982

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Step-by-step alignment details

A high performance AM tuner: Pt 3

Correct alignment is crucial in order to obtain optimum performance from our new Playmaster AM tuner. In this article, we describe the construction of a simple AM tuner alignment kit and give full alignment details. Also provided is a list of station frequencies for major Australian cities.

by JOHN CLARKE

Tuner alignment has always been a problem for the average constructor due to a lack of suitable test equipment. Our new Playmaster AM tuner overcomes this problem by using a simple alignment module in conjunction with the tuner's inbuilt frequency meter (ie, the digital readout). The only other items needed for accurate alignment are a multimeter and a set of plastic alignment tools for tweaking coil cores and trimmers.

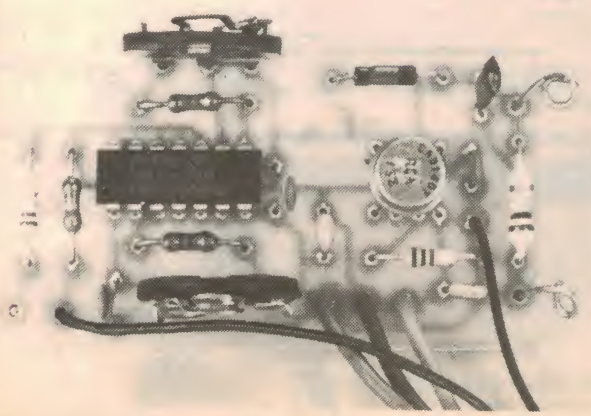
Basically, the operations involved are straightforward and repetitive. They simply involve adjusting coils, trimmer capacitors and potentiometers while observing either the digital tuner readout or the multimeter. Note that a plastic alignment tool must be used to adjust the coil slugs. Do not use a screwdriver or other metallic object, since these will affect the coil operation and give incorrect results.

Preamble

Before detailing the step-by-step alignment procedure, let us first give a general outline of the alignment process so that you have an overall picture of the whole process. As you know from reading the two previous articles, the tuner relies on a series of fixed and variable tuned circuits in order to provide its superior level of performance. The alignment procedure can be regarded as an initial "tune-up" to ensure that every circuit section is working at peak performance. While most readers will be unfamiliar with alignment of superheterodyne receivers, the process is not difficult but it does have a lot of individual steps, especially for a high performance unit such as this Playmaster.

Three sections of the tuner circuit require adjustment for alignment: the local oscillator, the RF bandpass filters, and the IF filter sections. Two further adjustments, although not strictly a part of the alignment procedure, are made to the signal strength meter and whistle filter circuits.

The AM tuner alignment module consists of two separate and adjustable RF signal generators plus a buffer amplifier and filter detector, all on a small PC board. The buffer converts your 20kΩ per volt multimeter into one with a 10MΩ input impedance. This high input impedance prevents any loading on the tuner circuit which may otherwise affect circuit operation. A description of the circuit and constructional details for the alignment unit are shown in the accompanying panel.



This simple alignment module generates two spot frequencies (600kHz and 1300kHz), and buffer's the input to your multimeter.

Oscillator range

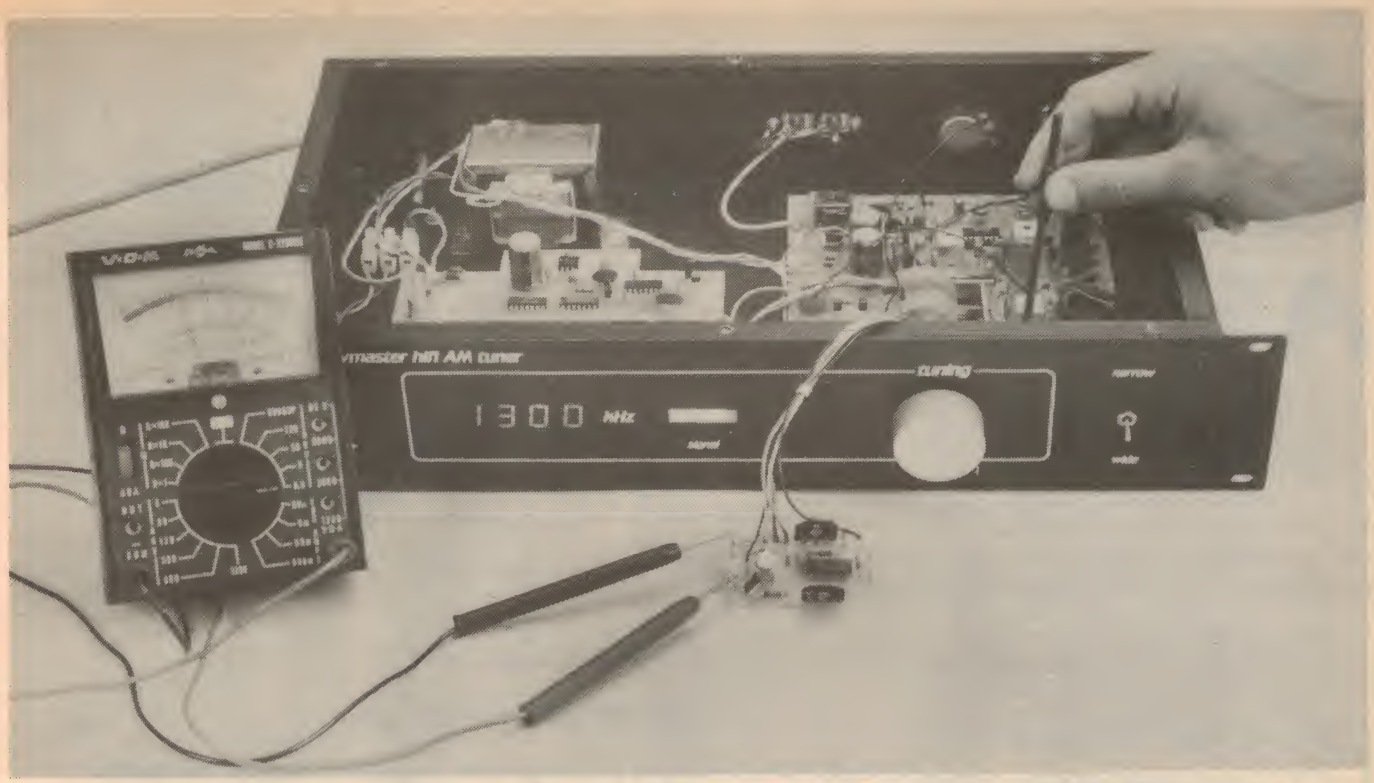
The first step in the alignment procedure is to adjust the range of the local oscillator so that the broadcast range can, in fact, be tuned in. We have designated the AM broadcast coverage as 520kHz to 1630kHz and since the local oscillator is always 455kHz above the tuned station frequency, this means that the oscillator must be variable over the range from 975kHz to 2085kHz.

However, since the digital readout in the Playmaster tuner actually measures the local oscillator frequency and "offsets" the reading by 455kHz, all we have to do is to adjust the local oscillator coil and trimmer capacitors so that the digital readout can be varied from 520kHz to 1630kHz. In this respect, alignment of the Playmaster tuner is easier than for a conventional superhet without a digital display.

RF Filters

The second step is to adjust the RF filters so that they track together and provide the same bandwidth throughout the range of the tuning capacitor. In this case, they are stagger tuned at the low frequency end of the broadcast band and peaked together at the high frequency end. The RF filters must also "track" with the local oscillator so that a 455kHz difference signal is always obtained at the output of the mixer.

Actually, it is quite difficult to achieve perfect tracking across the entire broadcast band due to non linearities in each section of the tuning gang. These non linearites cause slight tuning differences between the RF filters and the oscillator at various settings of the tuning capacitor. In practice, these differences have negligible effect and it is sufficient



This photo shows the trimmer capacitors in the 1st and 2nd RF stages being adjusted for a peak at 1300kHz.

to carry out alignment at just two frequencies – 600kHz and 1300kHz.

Stagger tuning for the RF filters is carried out in two steps. One RF filter, L2, is peaked at 604kHz while the second RF filter, L3, is peaked at 590kHz. What do we mean by "peaking"? In this case, we mean adjusting the coil slugs so that the maximum amount of signal is passed through at the desired frequency.

We measure the peak by monitoring the signal output at TP1 on the tuner circuit board. The op amp on the alignment module buffers and rectifies the signal at TP1 and feeds it to your trusty multimeter which is set to the lowest available DC voltage range. The respective coil slugs are then adjusted to give a maximum deflection on the multimeter (or maximum reading on a DVM).

We first set the tuning capacitor so that the digital readout displays 600kHz. Then we feed in a 604kHz signal from the alignment module to the antenna terminals. We then "peak" L2 as just mentioned. This done, the alignment module is set to feed in 590kHz to the antenna terminals and L3 is peaked.

At the other end of the dial, so to speak, we peak both L2 and L3 to the same frequency, 1300kHz. First the tuning capacitor is set so that the digital readout displays 1300kHz and a 1300kHz signal from the alignment module is fed into the antenna terminals. Then the rotary trimmer capacitors associated with L2 and L3 are both adjusted for maximum response at this frequency.

Unfortunately, this is where you discover how painstaking alignment must be because the adjustment of the trimmer capacitors will affect the previous adjustment performed at around 600kHz. Ergo, the stagger tuning at 600kHz must be repeated. And you guessed it, this effects the adjustment at 1300kHz. So the adjustments have to be repeated several times until you achieve the overall best settings. Normally, two repeat adjustments will be sufficient.

IF filter circuits

By now, you must be getting the general drift of alignment. Yes, the next step is to optimise the response of the IF filter circuits to 455kHz while still ensuring that they have the correct bandwidth.

To obtain that correct bandwidth, the slugs of the double-tuned IF transformers, L6 and L7, are peaked at slightly different frequencies. At the same time, in order that we can distinguish between the performance of both transformers, we heavily "damp" one coil with a resistor while the other is being peaked.

Narrowband ceramic filter

Having gone through the alignment procedure to this stage, it is quite likely that the centre frequency of the ceramic filter will be found to be not precisely at 455kHz. This is because the manufacturing tolerances on the centre frequency of the ceramic filter are ±2kHz. If the centre frequency is within ±1kHz of 455kHz, it is possible to use one or another combination of the capacitors C4, C5 and C6 to shift it to 455kHz precisely.

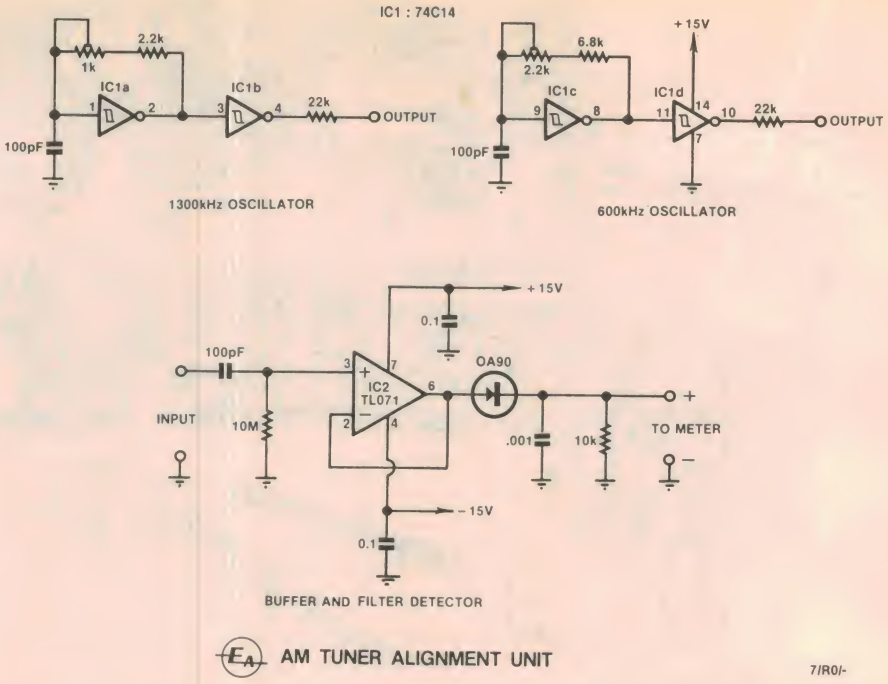
If the centre frequency is further away from 455kHz than ±1kHz, more drastic action is called for. No, you don't need that large hammer but it will be necessary to change the offset frequency of the digital readout circuitry. The offset frequency is selected by connecting the jam inputs of ICs 5, 6, 7 and 8 to the positive supply or 0V on the digital readout board. If you have not already done so, you should read through the full circuit description of the digital readout board in the October 1982 issue.

For the purpose of shifting the offset frequency to suit the ceramic filter centre-frequency it will only be necessary to change the jam inputs on IC5, as described later.

Unfortunately, if it is necessary to shift the offset frequency of the digital readout, it will then be necessary to repeat the alignment of the IF filter transformers. Strictly speaking, the local oscillator range should also be readjusted but since it will have been shifted by a maximum of only 2kHz you may elect to neglect this final touch.

Several steps in the alignment procedure remain to be explained. First, it is necessary to disable the automatic gain control (AGC) circuit on the tuner board. This is a standard requirement for the alignment of any superhet radio since if the AGC was operational it would

AM tuner alignment unit



The alignment circuit consists of two CMOS oscillators and a buffer amplifier.

The circuit for the AM tuner alignment unit consists of two ICs. A hex Schmitt trigger, IC1, is used to provide the two RF oscillators, while a high input impedance op amp, IC2, is used as the buffer for the multimeter.

IC1c is used as the 600kHz oscillator and functions as follows: Assuming the 100pF capacitor at the input, pin 9, is initially discharged, the input will be low and the output, pin 8, will be high. The 100pF capacitor now begins to charge via the 6.8kΩ resistor and 2.2kΩ trimpot until the voltage across the capacitor reaches the upper threshold of the Schmitt trigger input and the output goes low. The capacitor then discharges through the resistors and, when the capacitor voltage reaches the lower threshold voltage, the output of the Schmitt goes high again. The sequence then repeats.

Frequency adjustment is made with the 2.2kΩ trimpot; the smaller the value, the faster the capacitor will charge and discharge to provide a higher frequency.

IC1d buffers the output of the oscillator. This provides constant loading of the oscillator, regardless of the loading at the output of the buffer. The 22kΩ resistor at the output of the buffer provides attenuation of the signal to prevent overloading the AM tuner input circuitry.

IC1a is used for the 1300kHz oscillator and operates in a similar manner to the 600kHz oscillator. The 2.2kΩ resistor and 1kΩ trimpot provide the capacitor charge/discharge path. Frequency adjustment is with the 1kΩ trimpot. Buffering is provided by 1C1b, while the 22kΩ resistor on the output provides signal attenuation as before.

A point to note about both oscillators is that they produce square waves and this means that the oscillator outputs are rich in harmonics. However, this should not present any problems since the oscillators are only intended to be used at their funmdamental frequencies, ie, close to 600kHz and 1300kHz.

Op amp IC2 is connected as a voltage follower and this configuration, in conjunction with the IC FET input stage, provides a very high input impedance. The input is AC coupled with a 100pF capacitor and DC bias for the amplifier provided with a 10MΩ resistor. Consequently the input impedance of the buffer circuit is about 10MΩ at RF frequencies.

The output of the op amp is rectified by a germanium diode and filtered with a .001μF capacitor and 10kΩ resistor. The low DC voltage range of a multimeter can be used at this output.

automatically compensate for any changes in level brought about by the alignment adjustments. So, in order to perceive the changes wrought by each alignment step, the AGC is disabled. This is done by LK2 on the PC board.

Alignment procedure

Before starting the alignment procedure it is necessary to connect the supply leads from the alignment oscillator unit to the power supply outputs provided on the tuner PCB. These can be found near the 470μF filter capacitors, as shown on the tuner overlay diagram of last month. Link LK1 should be out of circuit, while LK2 should be in circuit to remove AGC action. Also, set each of the 3-30pF trimmer capacitors so that the capacitor plates are about 20% in mesh. The 10kΩ trimpot near IC5 should be initially adjusted to half setting.

Note that link LK1, which disables the oscillator, is not required if you use the tuner alignment module described here. This is because the output of the alignment module is high enough to swamp the local oscillator signal. If, however, an alternative signal generator with lower output is used, LK1 may have to be inserted to disable the local oscillator when aligning the RF filters.

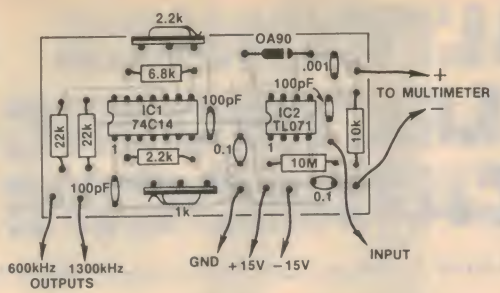
Note also that when soldering during the alignment procedure, power to the tuner should be switched off.

STEP 1
Setting the Local Oscillator Range

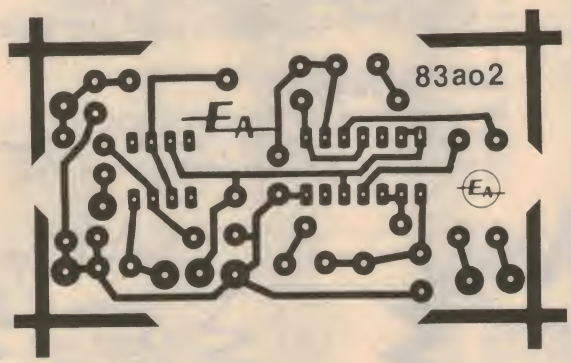
- Set the tuning capacitor so that the capacitor plates are fully meshed and adjust the slug in L9, the 7348 oscillator coil, until a reading of 520kHz is shown on the display.
- Set the tuning capacitor so that the plates are fully open and adjust the trimmer capacitor associated with the local oscillator for a reading of 1630kHz.
- Return to the low frequency end of the band (plates fully meshed) and readjust the L9 slug for a reading of 520kHz. This done, return to the high frequency end of the broadcast band and readjust the trimmer for 1630kHz. Return again to the low frequency end and check that the reading is still 520kHz. If not, continue with the adjustments until 520kHz and 1630kHz are displayed at the extreme settings of the tuning capacitor range.

STEP 2
Aligning the RF Filters

- Adjust the tuning capacitor for a reading of 600kHz. Connect the signal input of the alignment unit to test point TP1 on the tuner PCB, and connect a multimeter to the alignment unit. Set the multimeter to the 0.6V DC range (or similar range). Disconnect the local



Parts overlay and actual-size PC artwork for the alignment module.



PARTS LIST

1 PCB, code 83ao2, 35 x 64mm
1 74C14 hex Schmitt trigger
1 TL071, LF351, CA3140 FET input op amp
1 OA90, OA91, germanium diode
2 0.1μF monolithic capacitors
1 .001μF metallised polyester capacitor
3 100pF ceramic capacitors

RESISTORS (¼ or ½W, 5%)
1 x 10MΩ, 2 x 22kΩ, 1 x 10kΩ, 1 x 6.8kΩ, 1 x 2.2kΩ, 1 x 2.2kΩ large vertical trimpot, 1 x 1kΩ large vertical trimpot.

MISCELLANEOUS
Hook up wire, solder, multimeter, etc.

We estimate the current cost of components for this project is

$8.00

This includes sales tax.

Power supply filtering is provided by two 0.1μF capacitors, one connected from ground to the positive supply and the other from ground to the negative supply.

We constructed the AM tuner alignment unit on a printed circuit board coded 83ao2 and measuring 64 x 35mm. Follow the overlay diagram when inserting the components on the PCB. Make sure that the polarity conscious components – the diode and the ICs – are oriented correctly. We made eyelet holes from two short pieces of tinned copper wire to accept the multimeter probe leads, and these can be seen in the accompanying photograph. Flying leads are then soldered to the power supply connections, the buffer input lead, and the oscillator output leads.

In use, the AM tuner alignment unit is powered from the ±15 volt rails of the AM tuner. The relevant oscillator output (either 600kHz or 1300kHz) is connected to the antenna input of the tuner, while the input of the buffer is connected to either of the test points, TP1 or TP2 (see accompanying article).

oscillator connection to the digital tuner readout PCB and connect the output of the 600kHz alignment oscillator in its place.

● Adjust the 2.2kΩ trimpot of the 600kHz oscillator until a reading of 149kHz is shown on the display. The oscillator is now operating at 149kHz + 455kHz, or 604kHz. Disconnect the 600kHz oscillator from the tuner readout and connect the oscillator output to one of the antenna inputs of the tuner. Now adjust the attenuator so that no more than full scale is shown on the LED signal strength meter. This is necessary to ensure that the tuner circuits are not overloaded, thus obscuring the adjustment effects.

● Adjust the slug of L2, the 7155 antenna coil, until a peak is shown on the multimeter. Note that the coil will peak at two positions: towards the top of the coil and at the bottom of the coil. The slug should be screwed in until the coil peaks at the bottom position. This provides greater coupling between the two windings of the coil.

● Disconnect the 600kHz oscillator connection from the antenna input of the tuner and reconnect it to the digital tuner readout. Adjust the 600kHz oscillator until it reads 135 on the display. The oscillator is now operating at 135kHz + 455kHz, or 590kHz. Reconnect the oscillator to the antenna input of the tuner and adjust the slug in L3, the 2nd RF coil, for a peak towards the top of the coil.

● Connect the local oscillator to the digital tuner readout and adjust the tuning capacitor for a reading of 1300kHz. Now disconnect the local oscillator from the digital tuner readout and connect the 1300kHz alignment oscillator. Adjust this oscillator for a reading of 845kHz on the display by adjusting the 1kΩ trimpot. The oscillator is now operating at 1300kHz. Connect the 1300kHz oscillator to the antenna input of the tuner and adjust the attenuator for nearly full scale on the LED signal level display. Adjust the trimmer capacitors in each RF section for a peak on the multimeter.

● Reconnect the local oscillator to the digital tuner readout and set the tuning capacitor for a reading 600kHz. Repeat step 2.

STEP 3
Aligning the IF filters

● Set the tuning capacitor for a 600kHz reading, then connect the 600kHz alignment oscillator to the digital tuner readout. Adjust the 2.2kΩ trimpot for a reading of 145kHz. The oscillator is now operating at 600kHz. Connect the 600kHz oscillator to the antenna input of the tuner and set the wide/narrow switch to the wide position.

● Connect the buffer input of the alignment unit to test point TP2 (near IC6).

● Now solder R1 into position – you can use any value from 4.7kΩ to 10kΩ. This damps the first winding of the 1st IF coil. Set the attenuator so that the LED signal display shows close to maximum reading and adjust the top slug in L6 for a peak towards the top of the coil. Remove R1 and solder it in the R2 position. Again adjust the attenuator, then adjust the bottom slug in the L6 coil for a peak towards the base of the coil.

● Remove R2 and connect it in the R3 position. Readjust the attenuator, then

adjust the top slug in L7 for a peak towards the top of the coil. Remove R3 and connect it in the R4 position. Readjust the attenuator, then adjust the slug in the bottom of the coil for a peak near the base of the coil. Remove R4. Adjust the attenuator and adjust L8 for a peak towards the top of the coil.

STEP 4
Adjusting the Ceramic Filter

● Insert a link in the position marked C5, located near the ceramic filter. Switch the wide/narrow switch to narrow. Connect the local oscillator to the digital tuner readout and adjust the tuning capacitor to 600kHz. Connect the 600kHz alignment oscillator to the digital tuner readout and adjust it for a reading of 145kHz. The oscillator will now be operating at 600kHz. Connect the output from the oscillator to the antenna input and adjust the attenuator for a full scale reading on the LED signal level display.

● Adjust the 2.2kΩ trimpot of the 600kHz oscillator until a peak reading is observed on the multimeter. Now connect the output of the 600kHz oscillator to the digital tuner readout and check the display reading. It may deviate from 145kHz.

If the reading is higher than 145kHz, then the ceramic filter centre frequency is lower than 455kHz. Similarly, if the reading is lower than 145kHz, then the ceramic filter centre frequency is higher than 455kHz.

If the ceramic filter centre frequency is within 1kHz of 455kHz, it may be possible to shift it by using capacitors C4, C5 and C6. If, however, the ceramic filter is off frequency by more than 1kHz, then the offset adjustment for the digital tuner readout is altered and the IF filters realigned to suit the ceramic filter.

We found that a value of 4.7pF for both C4 and C5 would shift the frequency down by 1kHz, although this may vary for the particular ceramic filter. C5 is kept as a link. To raise the frequency, C4 and C5 are detached and a capacitor used at C5 to increase the resonance of the filter. We found that a .001μF capacitor would shift the frequency up by 1kHz. Again this value may vary depending upon the particular ceramic filter used.

● If the ceramic filter is more than 1kHz away from 455kHz, leave C5 as a link and delete C4 and C6. In this case, the offset frequency of the digital tuner readout must be adjusted to suit the centre frequency of the ceramic filter using links J1 to J4 for IC5. The following paragraph lists the changes necessary for the four expected IF values. All other links remain as for the 455kHz offset.

For an offset of 456kHz, the preload value is 9544 and J1, pin 4 of IC5, connects to the – rail. For an offset of 457kHz, the preload value is 9543 and link J2, pin 12, connects to the + rail, while J3, pin 13, connects to the – rail. For an offset of 454kHz, the preload value is 9546 and link J1, pin 4, connects to the – rail and J2, pin 12, connects to the + rail. For an offset of 453kHz, the preload value is 9547 and link J2, pin 12, connects to the + rail.

Once the offset of the digital tuner readout has been altered to suit the ceramic filter, it is necessary to realign the IF filters. To do this, set the tuning capacitor for a reading of 600kHz on the display. Now connect the 600kHz alignment unit oscillator to the digital tuner readout and adjust its frequency to 600kHz. Note that the display should be set to read 600 minus the offset of the digital tuner readout. Thus the display should read 143 for a 457kHz offset; 144 for a 456kHz offset; 146 for a 454kHz offset; and 147 for a 453kHz offset.

The IF filters are now realigned by soldering a resistor to R1, R2, R3 and R4 in turn as described in step 3.

Other adjustments

With the tuner now aligned, the LED signal level display can be adjusted. With the buffer of the alignment oscillator still connected to TP2 and 600kHz applied to the antenna input, adjust the attenuator for a 0.04V reading on the multimeter. Now adjust the 10kΩ trimpot near IC5 until the last (extreme righthand) LED of the signal level display just begins to light. This setting ensures that the tuner circuits are working at modest signal level and are producing a minimum level of distortion.

This done, disconnect the AGC shorting link, LK2, and re-connect the digital tuner readout to the local oscillator. The only remaining adjustment to be made is to the 9kHz whistle filter, but first we must be able to receive stations and for this an antenna will be required.

The loop antenna is made from a suitable length of insulated copper wire arranged as an upright rectangular loop. Ideally it should be oriented so that the plane of the loop points towards the transmitting antenna. In addition, it should be located close to the tuner to avoid a long feedwire. A good place to loop the antenna would be around a window frame or around a wall. In all cases, the pickoff point should be halfway up one vertical side, preferably on the side furthest from the transmitter. The feedwires are then twisted together and run to the antenna inputs on the tuner.

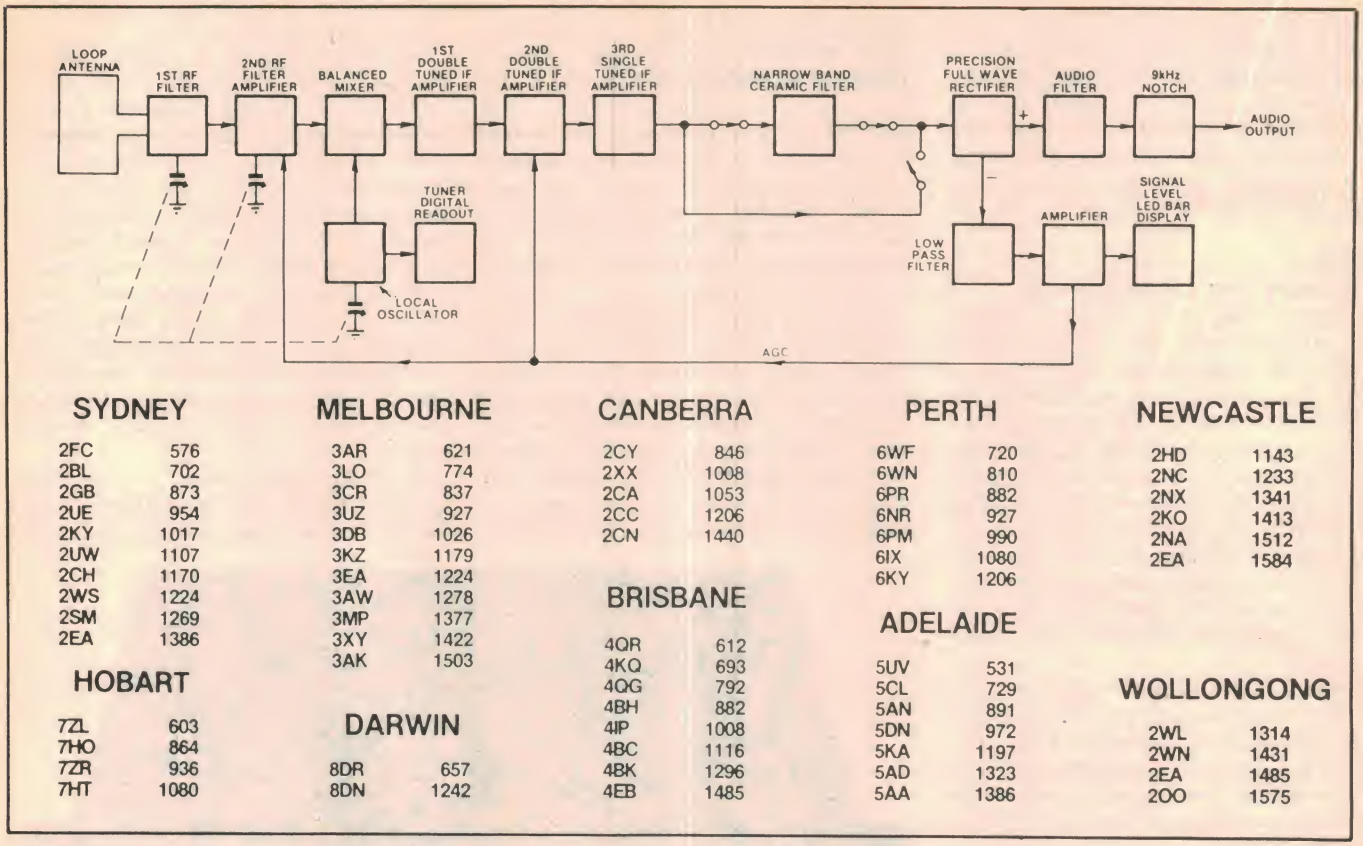
For strong signal areas, a small loop 1-metre square may be satisfactory, but for low signal areas a larger loop will give more signal output. The attenuator of the tuner should be adjusted so that the LED signal strength display does not overrange for any station and left on this setting.

The top panel artwork features a block diagram of the tuner and lists the station frequencies for major cities in Australia.

In use the tuner should be tuned exactly to the station frequency. Any deviation from the frequency will increase distortion and decrease the bandwidth. The artwork that we have produced for the top panel of the tuner lists the station frequencies for major cities of Australia. Note that a complete stations listing is unnecessary since the unlisted towns only have a few stations that are easily remembered.

If you are unable to remember the station frequency, the station may be accurately tuned by first switching to the narrow position and tuning for a peak on the signal strength indicator. The exact station frequency is then determined by noting that the displayed digits should all add up to 9 (some digits add up to 18, but adding again gives 9).

To adjust the 9kHz whistle filter, set the wide/narrow switch to the wide position and tune to a station which has a 9kHz whistle. During daylight hours, whistles



SYDNEY

2FC	576
2BL	702
2GB	873
2UE	954
2KY	1017
2UW	1107
2CH	1170
2WS	1224
2SM	1269
2EA	1386

HOBART

7ZL	603
7HO	864
7ZR	936
7HT	1080

MELBOURNE

3AR	621
3LO	774
3CR	837
3UZ	927
3DB	1026
3KZ	1179
3EA	1224
3AW	1278
3MP	1377
3XY	1422
3AK	1503

DARWIN

8DR	657
8DN	1242

CANBERRA

2CY	846
2XX	1008
2CA	1053
2CC	1206
2CN	1440

BRISBANE

4QR	612
4KQ	693
4QG	792
4BH	882
4IP	1008
4BC	1116
4BK	1296
4EB	1485

PERTH

6WF	720
6WN	810
6PR	882
6NR	927
6PM	990
6IX	1080
6KY	1206

ADELAIDE

5UV	531
5CL	729
5AN	891
5DN	972
5KA	1197
5AD	1323
5AA	1386

NEWCASTLE

2HD	1143
2NC	1233
2NX	1341
2KO	1413
2NA	1512
2EA	1584

WOLLONGONG

2WL	1314
2WN	1431
2EA	1485
2OO	1575

This top panel artwork has been reduced by 1.5:1 so that it will fit on the page.

may not be evident, but at night they will be quite noticeable. Rotate the ferrite cup of the 8010 coil for the best null.

The audio output level from the tuner should be sufficient to give full output from typical stereo amplifiers. If the level appears excessive it can be decreased by increasing the value of the 10kΩ resistor at the output of the whistle filter. The 100pF capacitor coupling the ceramic filter, C3, can be altered to provide a narrower response when the narrow/wide switch is in the narrow position. A 27pF capacitor will give a 2kHz bandwidth, while a 68pF capacitor will give a 3.5kHz bandwidth.

Some readers may also wish to experiment with a wider bandwidth than that specified. To widen the bandwidth, the 27pF top coupling capacitors, C1 and C2, can be increased to 33pF, While R5 should be 7.5kΩ, R6 6.8kΩ and R7 75kΩ. These changes give the audio filter a roll off at 15kHz and the bandwidth of the tuner is extended to a similar degree.

Be warned, however, that increasing the bandwidth increases the noise and the likelihood of "monkey chatter" becoming a problem at night. Monkey chatter is a form of interference caused when the sidebands of adjacent station fall within the passband of the tuned station. We consider the values originally specified to be the best compromise between noise and bandwidth.

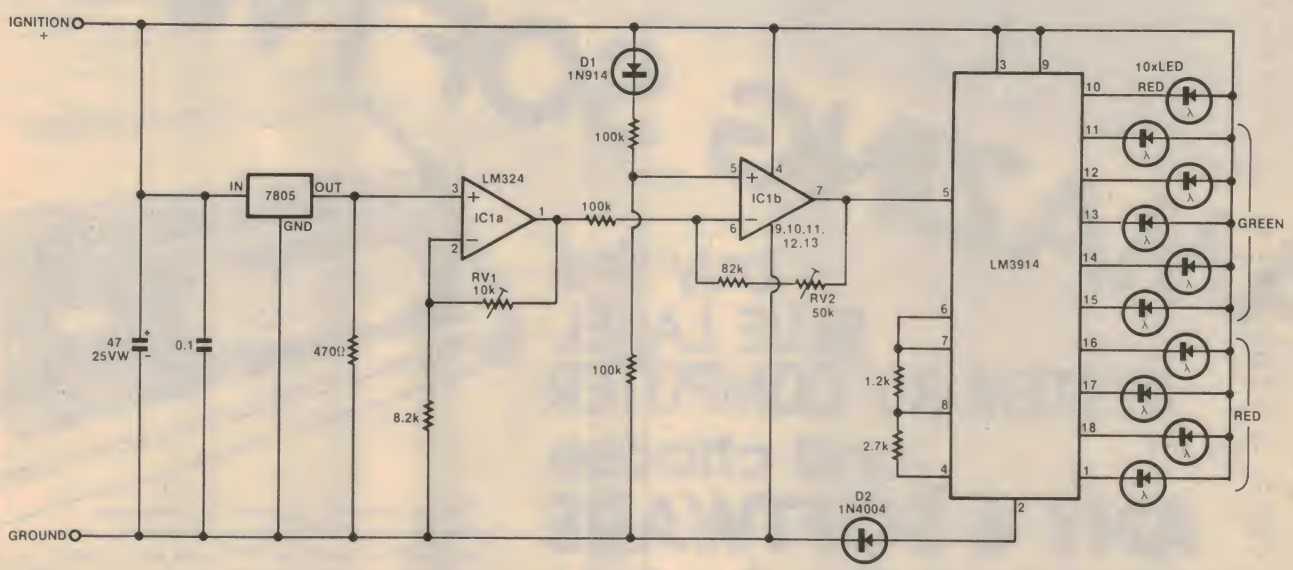
Of course all the foregoing article has rested on one very important assumption and that is, when you turned it on everything worked! What if it doesn't? Shudder, shudder! To help you face that possibility we have prepared a trouble-shooting procedure which will will pinpoint most of the likely faults.

One benefit of a superhet tuner such as this is that any fault is likely to be localised in just one stage and thus be easier to track down than a fault in a direct-coupled audio amplifier. So while faults are possible they should be fairly easy to correct.

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Suppressed zero car voltmeter



A centre zero ammeter is probably the most common way of monitoring a car battery, but that means running heavy wires from the engine bay into the car. The battery voltage, however, can be measured from under the dash with only light wiring being required. Battery terminal voltage is an indication of the current flowing into or out of it. The internal resistance causes the terminal voltage to drop below the open circuit voltage under discharge conditions and during charging the terminal voltage rises above the open circuit voltage.

Therefore a voltmeter would do the job without the need for heavy wiring. For greater resolution an expanded scale can be used to eliminate the measurement of insignificant voltage levels, in this case less an 10V.

The 7085 regulator IC1a and associated components form a nominal 8V reference which is adjusted by RV1 for offset calibration. IC1b subtracts the reference from the input and RV2 provides range calibration. D1 and D2 overcome the problems associated with operating op-amps near their supply rails.

Output from IC1b is fed to the input (pin 5) of an LM3914, a bar graph display driver. This, in turn, drives the 10 LEDs which make up the display. RV1 is adjusted to cause the first LED to come on for 10 volts input and RV2 is adjusted so that LED 10 is illuminated for an input of 14.5 volts.

Now we have an expanded scale bar graph voltmeter with a 10 LED display, the first LED coming on at 10V and each successive LED lighting in 0.5V steps up to 14.5V for the tenth LED to be illuminated.

Ten LED arrays are available but they are all the same colour and this makes the display slow to interpret. For ease of reading, make LED 1 to LED 4 red, LED 5 to LED 9 green and LED 10 red. This means the first green LED comes on at 12V giving an easily recognised reference point on the display and the single red LED identifies full scale.

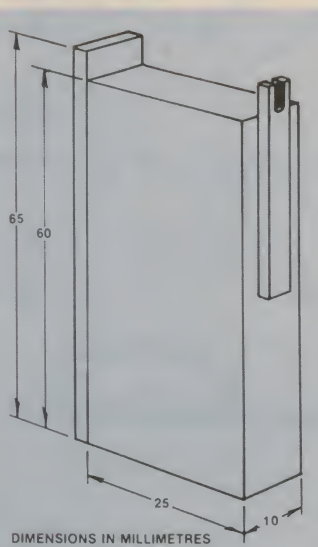
M. Gilbert,
Castle Hill, NSW.

Stripper modification for wire wrapping

Wire-wrapping is a quick and simple method of interconnecting electronic components. Many hobbyists use a hand-operated wire wrap-unwrap-stripping tool from Tandy. There are two minor irritations in using the stripping part of the tool. The first is that it is hard to hold. The second is stripping the wire to the correct length.

If the stripped end of the wire is too short there is the risk of not making a good joint. If the stripped part is too long, the wire leaves the groove in the tool and can tangle itself around the bit and break. This also results in a poor joint.

The stripping portion of the tool can be removed from the handle and permanently mounted in a piece of timber or plastic as shown. Stripping the wire to the correct length is now easy. Simply place the end of the wire in the jig up to the back plate, press down on it with the forefinger and pull.



J. Broekstra,
Indooroopilly, Qld.

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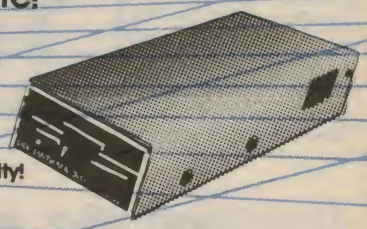

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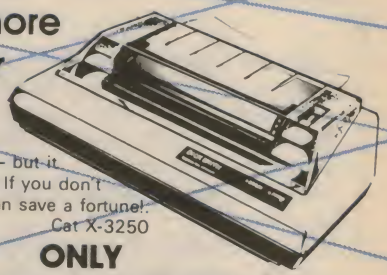

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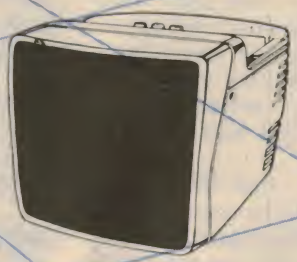

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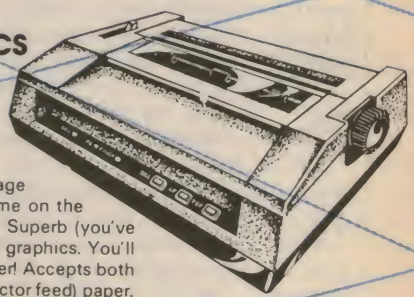

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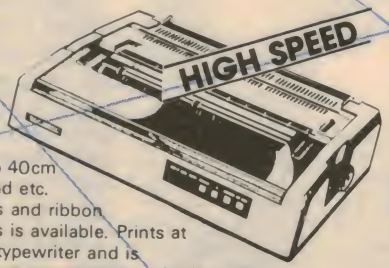

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SEE PAGE 98 FOR FULL ADDRESS

EA/A418/LA

The Serviceman

Catching the set that bounces — with dignity

One of the more frustrating aspects of servicing is the job which, superficially, appears to have been fixed, but about which there are some questions still unanswered. Has the fault really been found, or is there a more subtle defect lurking in the works which, sooner or later, will cause the set to bounce?

One set I had recently came into this category, and caused me quite a lot of worry before I was finally convinced that I had really fixed it. It was a Kriesler 59-4 colour set, one of the smaller variety, and the owner obliged by bringing it into the shop.

His story was somewhat garbled, particularly as to the exact sequence of events; a matter of some importance as it transpired. However, he started out by saying that the set had no picture but a bright line across the centre of the screen, and that seemed straightforward enough; a simple case of frame collapse. But then he went on to say that (apparently) before this happened the set had gone dead on two or three occasions, but that he had been able to restore it by switching it off and on again.

I pulled the back off the set and swung the chassis out into a working position. A quick run over the vertical output stages with the multimeter revealed the significant fact that neither of the two output transistors, TR656 and TR657, had any voltage applied to them. Nor was the reason hard to find; a 33Ω safety resistor, R651, between these transistors and the 35V rail supplying them, was burnt out.

AN EASY FIX?

The obvious thing to do was to replace this and see what happened, though I did not imagine for one moment that the cure was going to be as easy as that. If the resistor had cooked there had to be a reason and the best that I could hope for was that the replacement would last long enough for me to get some inkling as to the real fault.

Imagine my surprise, therefore, when I switched the set on and everything came up roses; normal picture, normal sound, good colour, etc. More importantly, there wasn't the slightest clue as to what had caused any of the original symptoms.

I pushed the set into a corner of the bench and let it run while I went on with other jobs, still expecting something to happen. But the hours went by and nothing did. Eventually, late in the afternoon, the owner called back to see how things were going.

I explained to him, as simply as I could, what I had found and that I felt quite strongly that this was not the real fault, only a symptom of it. Also, that I had found nothing to explain the total failure of the set which he had mentioned. What the set really needed was to be run on the bench, for several days if necessary, until the real fault showed itself.

But he wasn't keen on that. The set was obviously working and he was keen to get it back home. He was sure it would be all right. So, I warned him again and added that I would make some charge concession if he had to bring it back. And on that note he paid the account and went on his way. (But I knew he'd be back.)

In fact, nothing happened for about a week and I was beginning to think it had been one of those freak cures for which there is no explanation. Then the customer was back in the shop, complaining that the "so-and-so" set had done it again. More precisely, it transpired that it had first failed completely and remained in that condition for some time, but still switched on. Then it had partially recovered, but with no vertical scan.

"You realise, of course, that there's a slight additional charge for these fringe-area calls?"

I lost no time in getting the back off and checking on the 33Ω safety resistor. I wasn't really surprised when I found that it had burnt up again but the real surprise came when I switched the set on and found that it was now completely dead, which did not tally with the customer's description of it's behaviour the last time he used it.

At this point I tossed up as to whether to replace the safety resistor, or keep looking for what was, apparently, a second fault. I decided to replace the resistor first, thinking that it might have some bearing on the total failure, or that the search might be easier with the vertical circuitry restored.

BACK TO NORMAL

So I replaced the resistor and – yes you guessed it – the set returned to normal. By now I was completely confused. Did I have two faults, or only one with very strange symptoms. I put the set to one side, still running, and took another look at the circuit in the hope that I could work out what was going on.

I didn't have much luck. I tried to formulate a theory about a failure in the vertical circuit which was overloading the 35V rail and shutting down the power supply, but this just didn't fit the symptoms. In any case, once the 33Ω resistor had burnt up there would no longer be a load to shut down the power supply.

I gave up and went on with my other jobs.

The set continued to run for the next couple of days, with nary a flicker. Then suddenly it was completely dead. I was on to it like a flash, armed with multimeter and CRO, and anxious to see

what was happening to the 33Ω safety resistor. One glance was enough; it was cooking merrily, but I resisted the temptation to switch the set off. The less the circuit was disturbed at this stage the better!

I did check the 35V rail supplying this resistor, and found that it was spot on, in spite of the extra load, whatever it was. This much confirmed I turned my attention to the line output stage; the next most likely place to find the cause of a total failure.

Armed with an appropriate probe on the CRO I went straight to the line output transistor (TR710) and checked the waveform on its collector. There was none. Nor was there anything on its base, which is fed from the secondary of a driver transformer (T707). In the past, I have known this transformer to give trouble due to dry joints where it is fitted to the board, but a check on this seemed to rule that one out.

Next stop was the base of the driver transistor (TR707) and here we did have a normal waveform and, just to make sure, I checked the base of the previous stage (TR701) and again found a normal pulse waveform. So back to the line driver transistor where the pulses seemed to vanish after reaching the base.

I put the CRO probe aside and reached for the multimeter. There should have been about 30V on the collector of this transistor but, in fact, there was nothing. I traced the circuit back through the primary winding of the driver transformer and found that there was no voltage here either.

Fortunately, having traced things this far, the reason was fairly obvious. This stage is also supplied from the 35V rail and also via a 33Ω safety resistor (R706), and it was also burnt up. Why? I put my money on the driver transistor being short circuit and, for once, I was right; it was dead short between collector and emitter.

A new transistor and two new 33Ω safety resistors restored the set to normal operation. Which was all very gratifying, except that it left a lot of unanswered questions. Just what had failed first and to what extent was one fault responsible for the other, if at all?

Armed with the bare facts of what I had found I took another look at the circuit. It was the failure of the line output stage which provided the first clue. Auxilliary windings on the line output transformer provide several other voltage rails, including a 12V rail which, among other things, supplies the vertical oscillator stage.

So, when the line output stage failed, ie, when the set went completely dead, the vertical oscillator stage failed. And the vertical output stage is such that, in the absence of any drive, it draws excessive current. Hence the failure of the 33Ω safety resistor, R651, and the fact that, when the line output stage came good, the frame circuit had failed.

But why had the line output circuit failed and then come good again? There seems little doubt that the faulty line drive transistor (TR707) had been intermittent but why didn't it take out the other 33Ω safety resistor (R706) the first time it failed; why had this not failed completely until it had gone through several such cycles, including a couple on my bench?

One possibility is that the transistor, initially developed a high leakage rather than a dead short; enough to stop the stage working but not enough to take out the safety resistor. Then, on my bench, it broke down completely and finished the job. Well, it's possible I suppose, but not very likely.

Another suggestion is that when the transistor failed the first time, it cooked its own safety resistor (R706) to the point where this became intermittent. From then on the subsequent failures may all have been due to the resistor rather than the transistor until, on the bench, the transistor failed a second time and finished the job.

The truth is, there is really no way of knowing and it's all rather academic I suppose. At least I had been able to establish the association between the line failure and the frame failure, and that may well be a valuable lesson to remember.

HORIZONTAL OVERSCAN

And that's the end of the story? Not quite. With the major fault cleared I started to give the set a routine check for height, width, linearity, etc, and picked one of the morning test patterns as an aid. Whereupon it became immediately evident that the set was suffering from horizontal overscan. Not enough to be immediately evident on a program, but obvious on the test pattern.

I immediately recalled that the earlier model Krieslers, the 59-1 and 59-2 series, were prone to a similar fault, and that it was due to the failure of a transistor in the line output system, forming part of the linearity and correction circuitry. In fact, it can cause two width problems; if the transistor goes short circuit it can reduce the scan by 25mm or more on either side of the screen. In this case the error is so obvious that the owner invariably calls for help immediately.

But if it goes open circuit it can cause a similar amount of overscan, which is less obvious and may not be noticed at all by some people. Suspecting that this was what had happened to this set I compared the circuit with the older 59-1 circuit and concluded that they were sufficiently similar to support my theory.

This lead me to TR694, a small power transistor, type BD236. I pulled it out,

checked it, and sure enough it was open circuit. Well, I suppose you must win sometimes.

And that really was the end of the story. Except that I couldn't really charge for all the time I had spent on the job, but that's the luck of the game. I could only hope that the next set would be in and out in a few minutes.

MITSUBISHI REVISITED

My next story is a follow-up of one I told in the January 1982 notes concerning an AWA set, of the Mitsubishi "K" series, which had developed a funny (peculiar) fault in the sync separator stage. One of the points about the story was that I was unable to obtain a replacement for the sync separator transistor, a 2SA628, which was faulty, nor could I find a substitute type which would work in what was, apparently, a quite critical circuit.

I finished up "pinching" a 2SA628 from another part of the circuit – a switching transistor, Q433, in the vertical deflection chain – where it seemed that a BC327 would work quite happily. And, while I don't like having to pull tricks like this, there was really little alternative if I was to get the set back to the customer without serious delay. To make matters worse, he had already been given a raw deal by a previous serviceman.

Anyway, the set went back to the customer and all went well until a few weeks ago, almost 12 months after the original job. Then his wife was on the phone with a tale of woe about the set having failed again. On enquiring as to the nature of the fault I was given a rather garbled story which, as nearly as I could interpret, meant a partial frame collapse.

That suggestion rocked me a little, remembering that it was from the vertical circuit that I had swiped the vital 2SA628. Was the BC327 that I had substituted incapable of doing this job on a long term basis, perhaps due to peak voltages or something similar which I had failed to take into account?

I was still pondering on such possibilities when I arrived at the customer's home and checked the symptoms for myself. Sure enough, the lady's description turned out to be reasonably accurate; the vertical scan had dropped to about 100mm near the centre of the screen.

But that was not all. She went on to explain that the trouble varied. Typically, when first switched on, it would run with reduced scan for anything up to two hours, then it could come good and might stay that way for another two hours or more, but would usually collapse again, eventually. All of which didn't help much and, on top of my worry about the BC327, set me drawing heavily on my worry bank.

The only thing I was sure at this time was that it was no job for the lounge room. Fortunately, I had a spare set on hand which I could loan them, so it was arranged that I fetch the loan set and then take the Mitsubishi back to the workshop.

Back at the shop I switched the set on again and it came up exactly as it had in the house. Well, that was something, anyway. Hoping it would stay that way, as it was supposed to, I reached for the multimeter and approached the vertical deflection circuit. This consists of no less than eight transistors; two in the oscillator circuit (Q431-432), the vertical switch which I had mucked about with (Q433), a vertical amplifier (Q434), vertical driver (Q435), an inverter (Q436), and two output stages (Q491-492).

My first thought was that partial collapse in this circuit might be due to one of the output transistors dropping its bundle, either partially or completely, but all the voltages around these checked out almost exactly with the circuit. I might have known it was not going to be as easy as that.

OUT WITH THE CRO

I stoked up the CRO and prepared to do battle at a more scientific level. Still worried about the BC327, I made my first check at the base of this transistor, which is shown as check point 23, and for which a waveform is given. This waveform shows a negative going pulse of about 9V p-p, and this is exactly what came up on the CRO.

The next check point is No. 24, at the base of the following transistor, the vertical amplifier, Q434. The waveform shown for this point is a sawtooth of 3.8V p-p, and this was where things were obviously going wrong. The best that the CRO could come up with was about 2V. (By now I was feeling really worried about that BC327.)

I went back to the multimeter and began checking voltages around the BC327. There was about 19V on the base, which checked with the circuit, and 11.6 on the emitter, which was also correct. But all was not well with the collector. This was supposed to have 0.54V on it, but was actually reading about 10V.

No prizes for guessing what I did next. I whipped out the BC327 and put it on the tester, fully expecting to find it broken down or leaky. But no; it read normal in all respects. Nevertheless, I fished out a new one and fitted it, just in case. But all this did was to put things back exactly as they were before. Well, at least it seemed that I had cleared the BC327, and that was a relief.

At that point fate took a hand. I was called away to another job which I could not conveniently ignore at that time, so I decided to leave the set running and see if it would come good as the customer had predicted. Sure enough, when I returned a couple of hours later it was back to an almost full scan; just slightly short at the bottom of the screen.

The CRO was still connected to check point 24, so I turned up the brightness and found that the waveform was now approaching 4V p-p, as the circuit said it should. Not wishing to risk disturbing the situation by probing things with the meter probes, I reached for the freezer spray and began systematically freezing each component in the vertical circuit, starting at the vertical switch and vertical amplifier stages, and spreading out as I drew blanks.

OVERSCAN

The trouble was I kept on drawing blanks until there was virtually nothing left to try. I was still contemplating this situation when the picture suddenly went into an overscan condition, and I remembered that I had advanced the scan control previously, to note what effect it had. I assumed that what I was now seeing was proper operation for the first time.

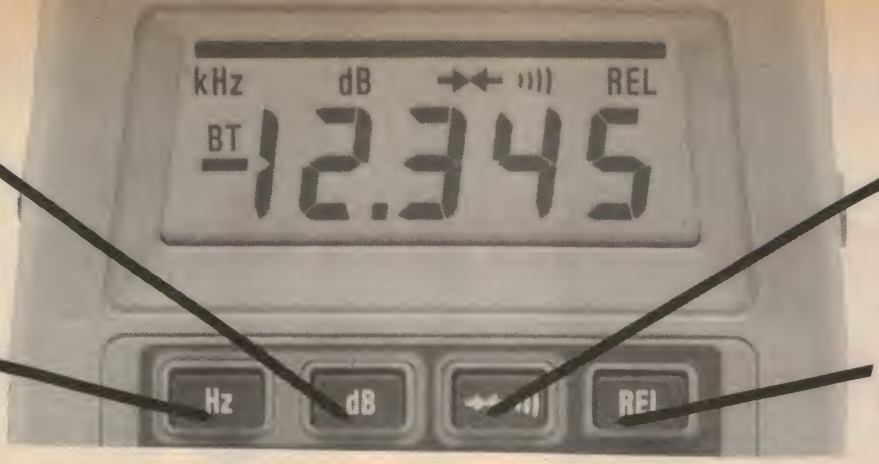
But it didn't stay that way for long. It dropped back to the near normal scan for a few minutes, then went back to the original fault condition. And there it stayed. Once again I decided to take a break, mainly because I suddenly realised that it was past lunch time and I was hungry. (Yes, these jobs get you like that sometimes.)

Naturally, I didn't think of much else over lunch. In fact, I took the circuit to lunch with me. (All right, the circuit didn't need lunch, but you know what I mean.) Looking at the circuit again I tried to visualise where the spurious 10V on the BC327 collector could be coming from, now that the transistor itself had been cleared.

The base of the following stage, the vertical amplifier, is biased to about 9V from a separate rail but this point is isolated from the BC327 collector by a diode (D436). Could this diode be leaky? If it was it might explain the spurious voltage.

I gulped down the remainder of my caviare and champagne as quickly as was prudent (Mrs Serviceman's sandwiches and a tin of TAB actually) and hurried back to the bench. I lifted one end of the diode and checked it, but no joy; it was working exactly as it was

Continued on p133



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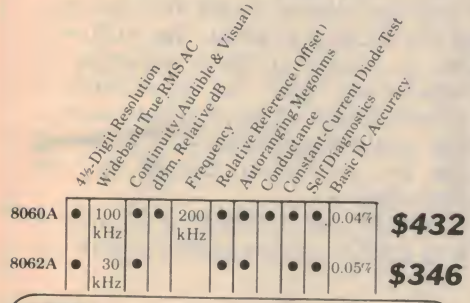

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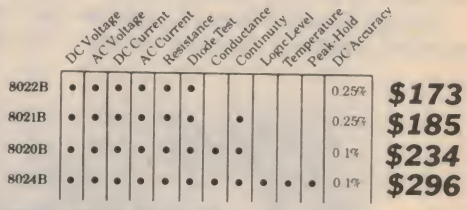

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Remote infrared TV sound control

Part two

As noted in last month's article on the remote infrared TV sound control, some TV sets have a DC volume control. This article shows how to modify the circuit to work with these later model sets and, as it turns out, less components are needed.

by LEO SIMPSON

Featured with this article is the 5.5MHz FM detector volume control and audio output circuit of a Toshiba TV receiver which may be regarded as a typical example of a set with a DC volume control. The volume control works by varying the DC voltage at one of the IC pins. As such, the volume control is merely wired as a variable resistor and so only two wires are needed.

In the Toshiba set under discussion, the sound volume is at a minimum when the voltage across the volume control is at a maximum and vice versa. In order to make the remote volume control work with this set, there are two aproaches, as noted briefly last month. First, the circuit as presented last month can be wired in series with the audio output from the IC. In this case, C613 would have to be removed and the two shielded cables from the main receiver board connected in place of the capacitor.

In most TV sets with a DC volume control this approach would not be easy. An alternative and easier approach is to reconfigure the receiver circuitry around IC1 as a variable switched resistor which can be connected directly across the volume control of the TV set. Before we detail how this is done, let us recap briefly on the operation of the circuit presented last month.

In the original circuit on page 42 of the January 1983 issue, the 4051 is used as a passive voltage divider consisting of a 100kΩ resistor in series with the audio signal and one of six shunt resistors or a transistor (for full attenuation). The 4051 is used to select either none (for maximum output) or one of the six shunt resistors or the transistor. The 4051 is controlled by the 4029 binary up-down counter.

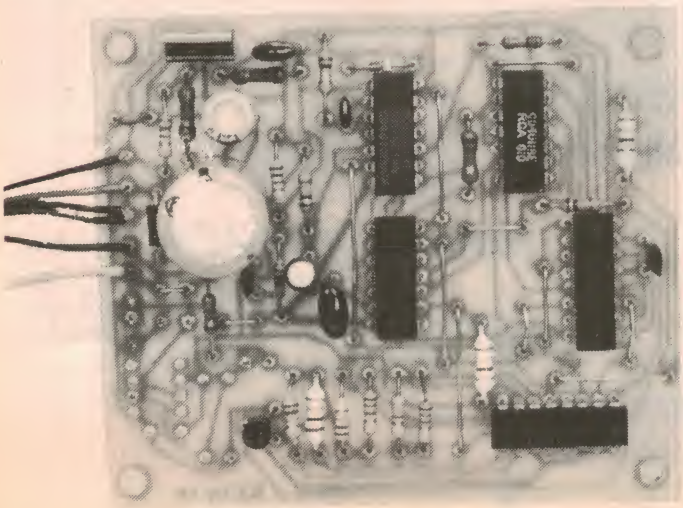
As it stands then, the 4029 is caused to count up to increase the volume and down to decrease the volume. Thus, the minimum count turns on the transistor, Q5, to shunt all the audio signal to the 0V line and silence the TV sound. IC6 is used to buffer the audio output.

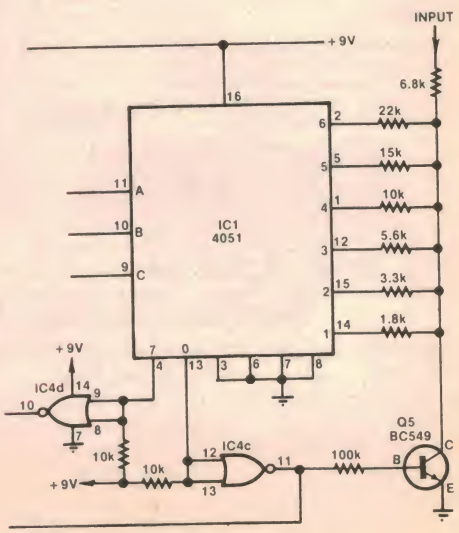
Since the DC volume control circuit is a two-wire control, the remote control circuitry cannot be used in the same way. It must be used as a variable DC shunt which can be connected in parallel with the existing volume control. This means that IC6 can be dispensed with, as can the associated input and output coupling capacitors.

Now look at the amended circuit which shows only that part pertaining to IC1. The remainder of the circuit is unchanged. For minimum DC voltage at the input (and thus maximum sound volume from the TV set), Q5 is turned on to connect the 6.8kΩ resistor directly to the 0V line. For lesser volume conditions, one of pins 14, 15, 12, 1, 5 or 2 are connected to 0V by the 4051.

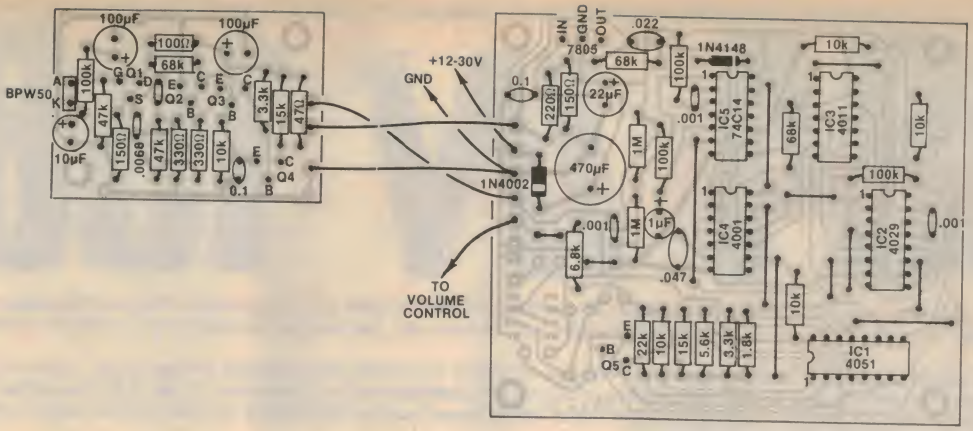
The fact that transistor Q5 is turned on for maximum volume, whereas in the original circuit Q5 was turned on for minimum volume, means that the sense of the circuit is inverted. The 4029 now has to count up for a reduction in volume and down for an increase in volume. This is achieved without any further circuit modifications by swapping the up and down buttons on the transmitter.

There is also a difference in practice with this DC volume control version. In





At left is the second version of the receiver board showing the vacant space in one corner of the board. At right is the modified circuit.



Only three connections need to be made to the TV set; they are the two for the supply and the volume control connection.

the previous version, the TV set volume control was set to provide a normal volume level and the 4051 would select a preset volume at switch-on. This is accomplished by means of the preset enable (pin 1 of IC2) and the associated jam inputs which give a preset count of 3 (ie, pin 12 of IC1 is selected).

The same preset condition applies to this DC volume control version of the circuit but now the TV set volume control is set for minimum volume, ie, fully anticlockwise. The reason for this is that if the TV set volume control is advanced, the remote volume control circuit will be unable to provide a zero volume control condition. Remember that the volume control works by reducing the DC voltage to give an increase in volume level.

The resistor values we have selected may not necessarily be appropriate for all sets with DC volume controls. It would be wise to check your TV set manual on this aspect before beginning construction. Better still, you can try the effect of particular resistance values shunted across the TV set volume control by using jumper leads. **(Caution: This cannot be done safely on live-chassis sets).**

It is also possible that some DC volume controls may work in the opposite sense to the example we have shown. In that case, the up and down buttons on the transmitter would be used as in the original version.

Construction of the printed circuit boards is exactly the same as presented in the January 1983 issue with the exception that IC6 and associated components are omitted, as mentioned previously.

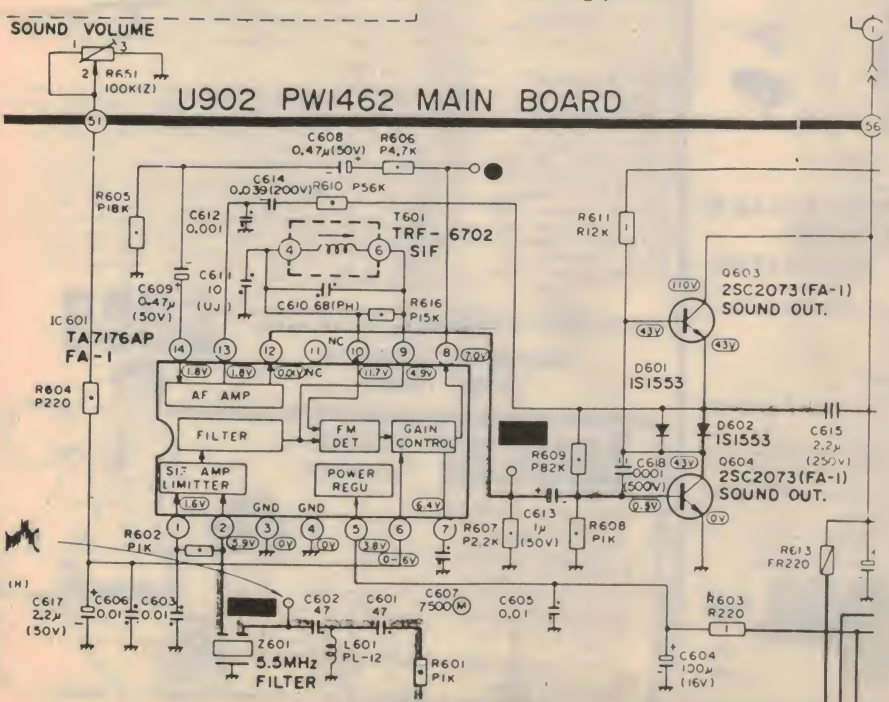
Testing

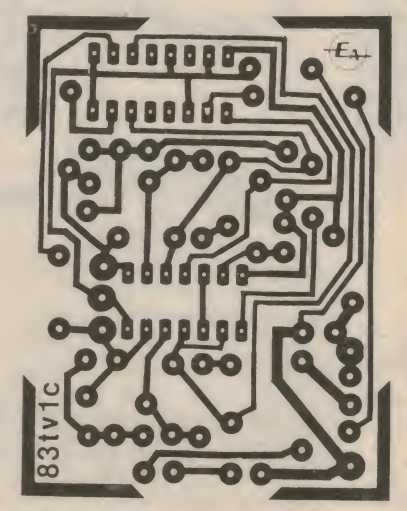
Testing this version of the circuit is simpler than last month's version. Wire the interconnecting leads between the two receiver PCBs and connect a power supply capable of providing between 12 and 30VDC. Check that the regulator is supplying close to 9VDC and that all ICs are receiving power.

Now connect the 9V supply from the regulator to the volume control input on the receiver board. Connect a multimeter (switched to a suitable DC voltage range) between 0V and the junction of 6.8kΩ and the shunt attentuator resistors. Now operate the transmitter and check that the voltage reading can be varied in eight steps between 9V and 0V.

If the voltage varies by only a few steps and not over the correct range, the most likely fault is that one of the A, B or C lines from the 4029 is open circuit. With testing complete, installation in the TV set can proceed.

Only three connections need to be made to the TV set circuitry. One to the main 12-30VDC supply, one to 0V and one to the volume control wiper. The latter connection can be made at the volume control itself which is usually somewhat inaccessible, or to the appropriate wire connection on one of the TV set PCBs. Set the TV set volume control fully anticlockwise and you are in business.





At left is portion of a recent model Toshiba TV set showing the sound stages and DC volume control. Above is a corrected version of the transmitter PCB which was shown on page 51 of last month's issue.

1984 IN 1983

The one-chip microprocessor started it almost 10 years ago. The concept of the low-cost micro has affected the world profoundly since then. It arrived a year early. Now, in 1983 – a year early some might say we have the mechanical equivalent to the microprocessor – the low cost micro-robot.

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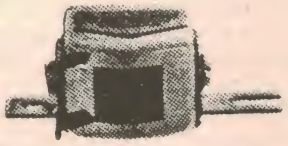

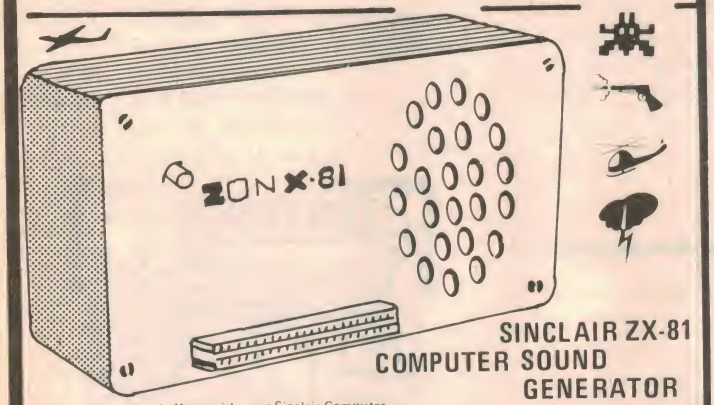

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SPECIFICATIONS (BRIEF)

* Keyboard – 2½ octaves (30 notes) may be stepped through 5 octave range from 16' to 1' using the "Range" switch * VCO1 – 10Hz to 10kHz, triangle output to VCA, ramp and square outputs to VCF * VCO2/LFO – VCO mode 10Hz to 10kHz. LFO mode 0.1Hz to 30Hz. * Sub octaves – 2 divide-by-2 * Noise – white noise source with level control. * Envelope – attack and release times variable 0 to 10 seconds * Retrigger – causes the envelope shaper to retrigger itself with a repeat time equal to the sum of the attack and release times. "Sustain" operates in 3 modes, manual, auto and hold. * VCF – state variable filter with manual control of roll-off frequency. * VCA – controls output volume of synthesiser * Sample and Hold – analogue memory samples instantaneous output voltage from VCO2/LFO each time envelope ends. * Sweep * Thumbwheel – Manual level control * Power amp – output 2 watts into 8 ohms plus headphone socket * Sequencer socket * Size: 19½" x 14" x 5½". Weight: 10lb. Power: 240V AC 5W.

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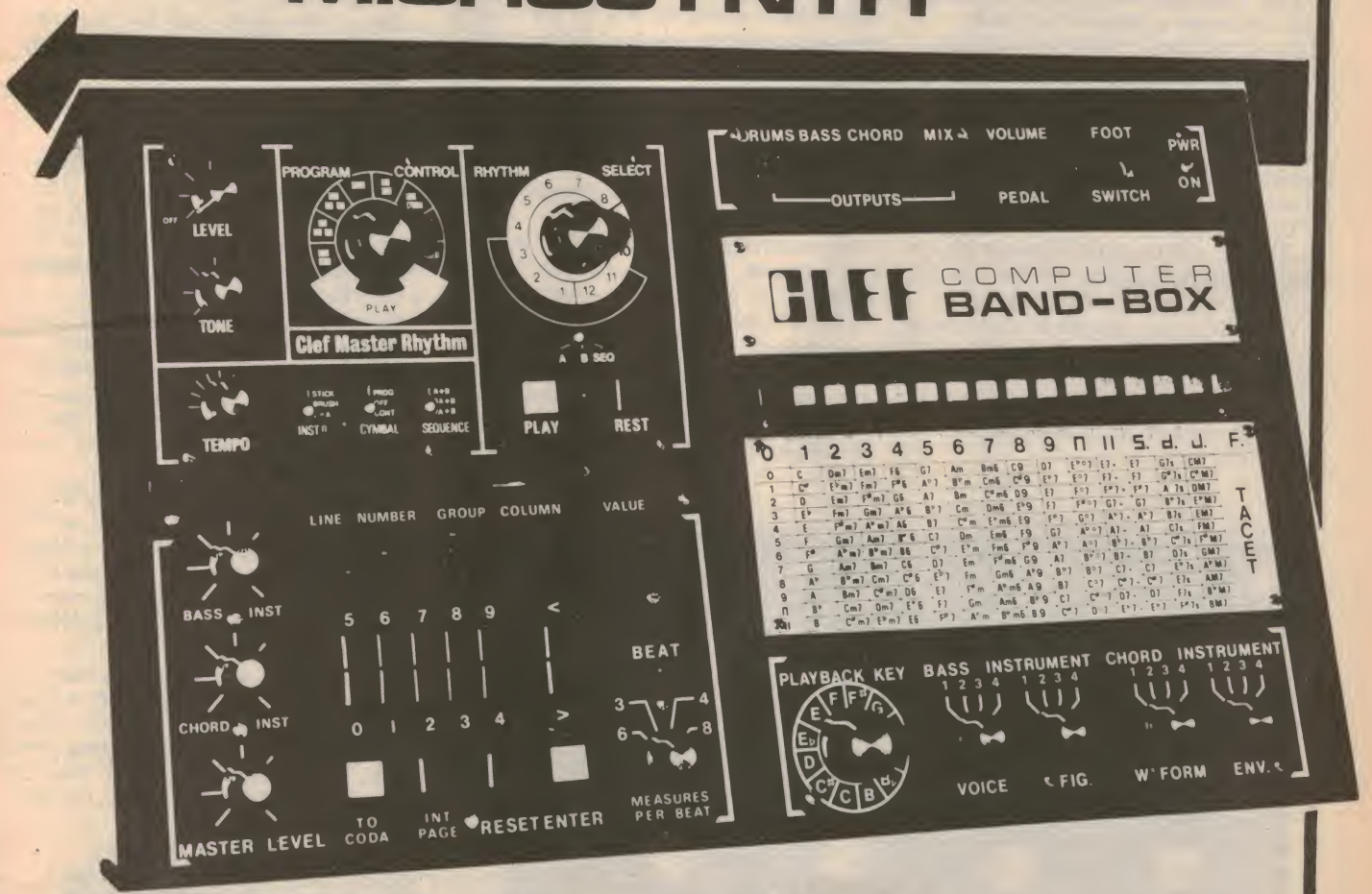


AT LAST ~ THE BAND BOX

Two projects for the price of one!

Wheatstone Bridge and resistance box

A Wheatstone Bridge is a valuable addition to any workshop. It can be used to measure resistance, for calibration purposes and continuity checks over the longest lines — all with an accuracy and stability far beyond the ordinary ohmmeter. The price won't break the bank, either.

by COLIN DAWSON and K. J. ELLIS*

With the ready availability of 1% tolerance metal film resistors at low prices, it has become possible to design and construct a modern economy version of the classic "Wheatstone Bridge". Despite its laboratory origins, this device is a valuable adjunct to any hobbyist workshop, having a potential accuracy and stability as good as or better than similar digital instruments costing many times its price. The Wheatstone Bridge uses both digital and analog techniques, and could well lay claim to being the first digital readout device, by the comfortable margin of a century or so.

The unit to be described is simple to construct, compact and portable and costs little more than a cheap 20,000 ohms/volt multimeter. It can be used to measure the DC resistance of virtually any component over a wide range, with an accuracy governed only by the precision of its internal resistors. Values from 0.001Ω to 9.999MΩ – at up to four easily read significant figures – are given, and no calculations are involved in normal usage. Using "off the shelf" resistors in the critical areas should give around 1% accuracy, with a maximum error of 2% at the range limits.

No external accessories such as probes are required, and for portability the instrument is powered by low-cost batteries with long life expectancy. A simple operational amplifier drives a small centre-zero tuning meter, eliminating the delicate and expensive galvanometer normally employed in the classic Wheatstone Bridge. Accuracy is not required of either the DC amplifier or meter – in fact "repeatability" is their only critical parameter.

The Wheatstone Bridge can be used to calibrate or adjust meter shunts or multipliers, matching or selection of accurate resistors for equalisers and attenuators, coil and transformer winding resistances, switch contact checks and a multitude of similar tasks. In short, an instrument capable of results far beyond a multimeter's normal resistance ranges.

Subject to the case chosen (a suitable unit could even be reposing in your junkbox), the all-up cost for the complete unit runs at between $30 and $40 which by today's standards is fairly modest.

*K. J. Ellis 84 Lamorna Av, Beecroft NSW 2119.

The Wheatstone Bridge can measure resistance values from .001Ω to 9.999MΩ.

How it works

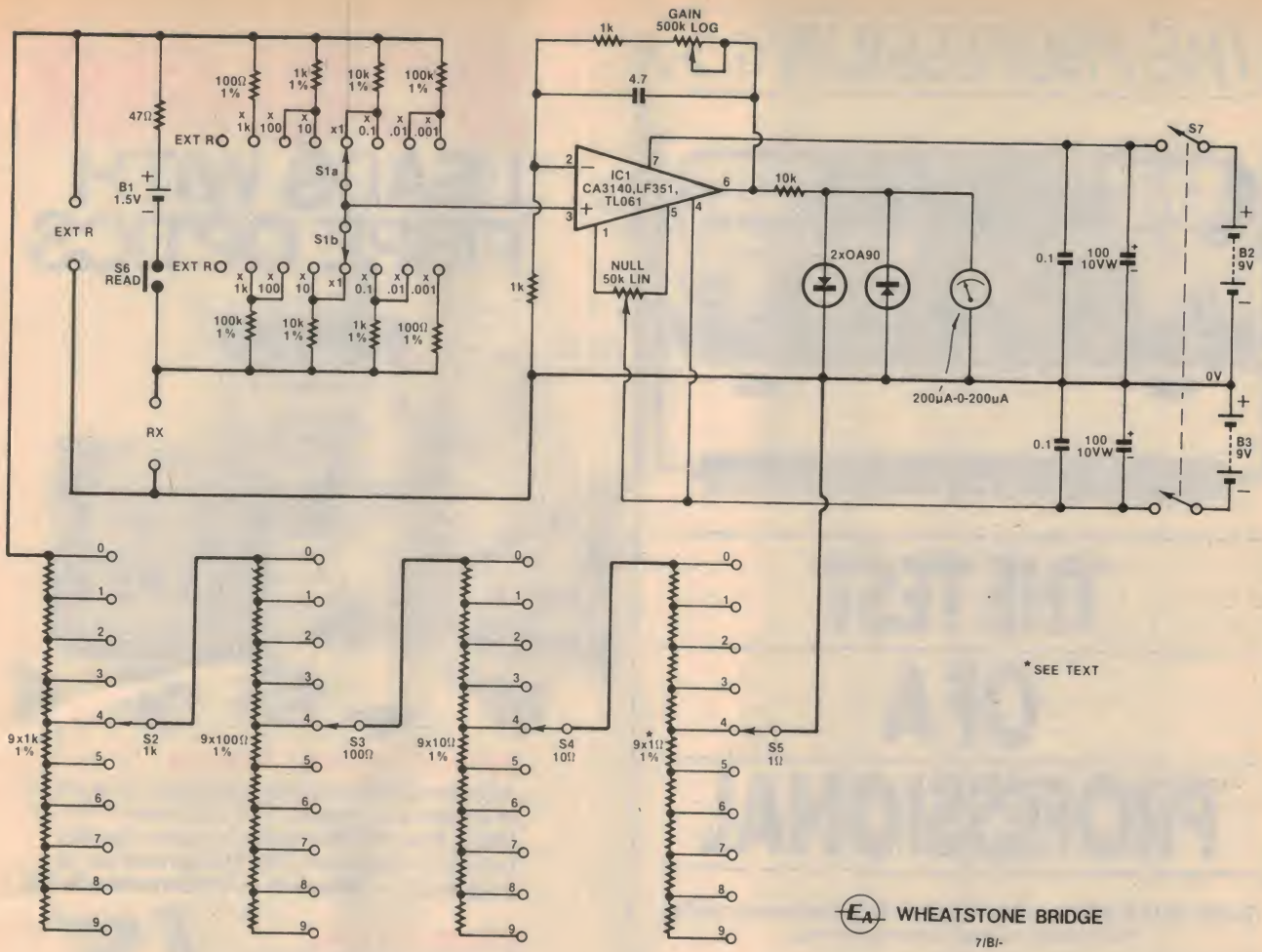
The circuit of the basic Wheatstone Bridge is shown in Fig. 1. When resistance RY is adjusted so that RA/RB = RY/RX, a "balanced" condition of the bridge exists and a "null" or zero reading is seen by the meter or null indicator. By varying the ratio arms RA and RB and calibrating RY, an enormous range of unknown resistance RX can be determined, the accuracy being determined by the precision of RA, RB and RY. This, of course, is where the 1% resistors come into the picture.

The "null" indication is controlled by the error signal, the sensitivity of the meter and the bridge excitation voltage, E. A centre-zero meter is mandatory here, as high or low conditions can occur. This assists in the setting of RY to the correct balance point.

RY is actually a chain of resistors, as shown in the circuit diagram. It consists of four single pole 12 position rotary switches of the normal shorting rotor type. Each switch has nine resistors wired across its fixed contacts. The switches, from left to right, are:

S2, covering 0-9kΩ in 1kΩ steps
S3, covering 0-900Ω in 100Ω steps
S4, covering 9-90Ω in 10Ω steps
S5, covering 0-9Ω in 1Ω steps

These four switches and their associated resistors will be referred to as



The circuit is a classic Wheatstone Bridge with Fet-input op amp IC1 operating as a differential amplifier.

the decade switches, the whole group as the decade box. It can be seen that the four decade switches in series cover a range from 0 to 9,999Ω and intermediate values between these limits are obtained in 1.0Ω steps, governed only by the accuracy of the resistors and the relatively insignificant resistance of the switch contacts and internal wiring in series with RY.

The use of 1% resistors for S2, S3 and S4 and the series method of operation – tending to average out the highs and lows – means that better than 1% accuracy can be expected over this section. S5 uses 2% carbon resistors as values below 10Ω are unavailable in metal film. The 2% types can be selectively measured if desired (as can indeed the resistors for S2, S3 and S4) if higher accuracy is sought, but bear in mind that S5 really only controls the fourth significant figure, which is of least importance.

Decade box feature

RA and RB form the arms of the bridge in conjunction with S1, and will be henceforth called the multiplier. A two deck, single pole 8-position switch is called for here. By setting this switch to the external ("Ext") position, the decade box is isolated from the rest of the bridge circuit. This allows it to be used independently, with the adjustable resistance value taken from the "R OUT" terminals.

The decade box is invaluable when used for design or experimental work – in fact wherever an "off beat" resistance value below 9,999Ω is required. This can be a real life saver on occasion, however the total wattage rating of RY must naturally be respected.

Ideally the eight resistors used with S1 should be as accurate as possible, handpicked if this is practical. Using normal 1% resistors and taking the worst possible cases of RA 1% high, RB 1% low or vice versa, an error of 2.02% one way & 1.98% the other would be introduced. This error is reducible to zero, but the maximum errors given above could reasonably be expected to be lowered by the law of averages, should off-the-shelf 1% resistors be used.

Note that the fourth significant figure would be slightly suspect if stock 1% values are used.

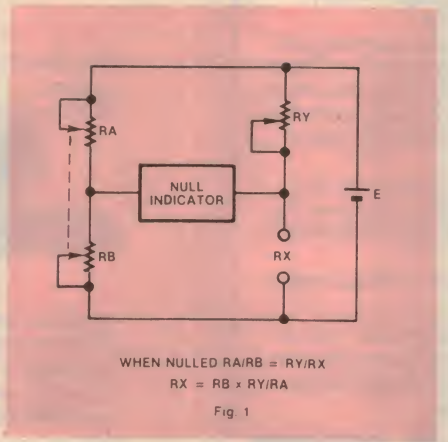
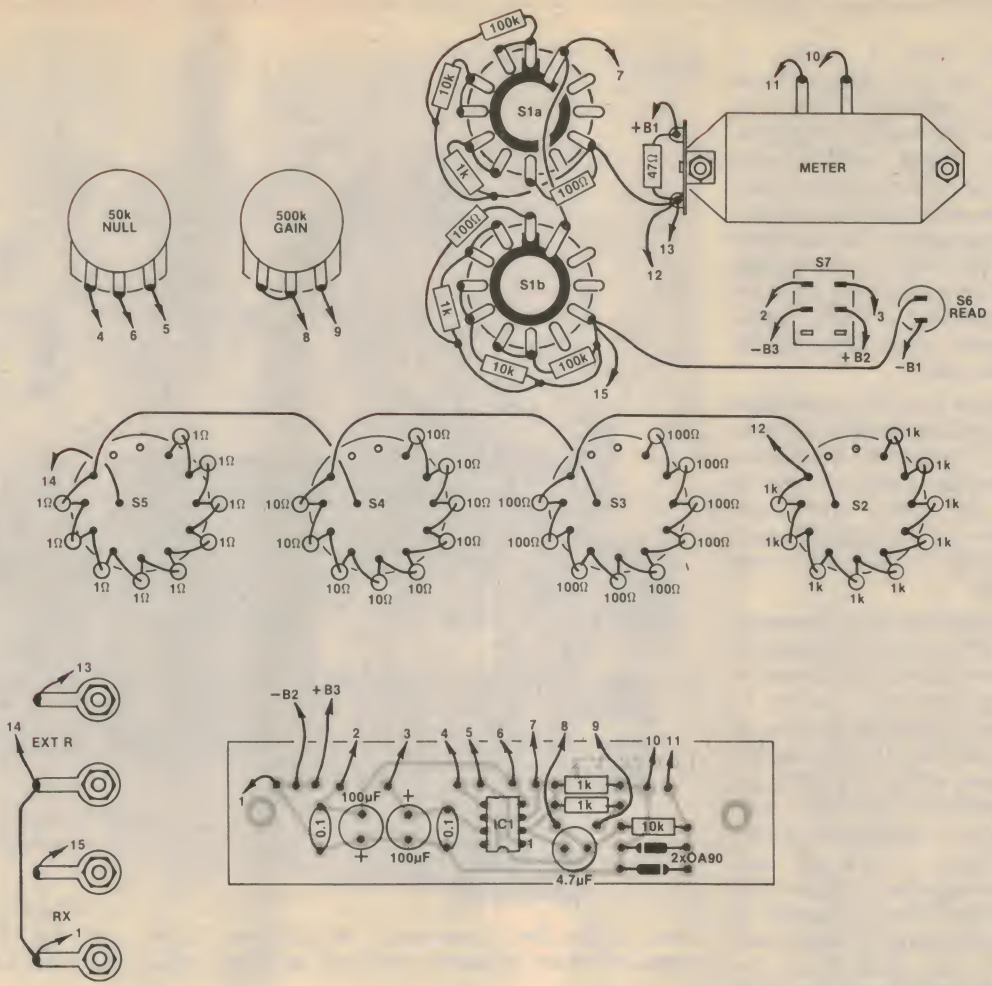


Fig. 1

Circuit description

The electronics of the instrument are quite straightforward and quite conventional, and will therefore be described briefly. A printed circuit board (PCB) measuring 106 × 28mm is used for the amplifier circuitry. The actual op-amp used can be either an LF351, CA3140 or for low battery consumption, a TL061. The bandwidth of the amplifier will vary with



Note that two unused contacts on switch S1a,b are used as wiring points.

the setting of the gain control, but as we are using the op-amp as a DC amplifier this is of no consequence.

The non-inverting input of the op-amp (pin 3) is fed from the junction of RA and RB (Fig.1). The inverting input (pin 2) is grounded via a 1kΩ resistor and also has feedback from the output (pin 6) applied to it. There are two paths for this feedback which can be considered as AC and DC feedback. The AC feedback path is provided by a 4.7µF non-polarised capacitor which severely attenuates the gain of the op-amp for any AC signal. DC feedback is provided by a series 1kΩ resistor and a 500kΩ variable resistance. The variable resistance is the gain control and can be adjusted from the front panel of the Wheatstone Bridge. The gain is adjustable over the range 1-500.

The output of the op-amp can swing to virtually the supply rail voltages of ±9V. In fact it can be expected to do so when a large input error exists, ie when the value of RX differs markedly from the value selected in the decade box. To protect the meter movement, which would be grossly overloaded by such voltages, a 10kΩ resistor is included in series with the meter. The value of 10kΩ is a compromise between providing meter protection with large input errors and an acceptable amount of sensitivity with small input errors. As such, it is still possible to deflect the needle against the "stoppers", but additional protection provided by back-to-back OA90 germanium diodes across the meter ensures that the amount of overload is not likely to be damaging.

Offset voltage adjustment is provided to pins 1 and 5 of the op-amp by the 50kΩ potentiometer, eliminating a false "null" and becoming the front panel "balance" control. No calibration of the circuit is required other than the correct setting of the "balance" control before taking a reading. Offset drift is non-existent at normal gain settings.

As most of the components are mounted on the front panel controls, the printed circuit board used for this project is quite small, measuring only 28 × 106mm. This board – coded 83wb1 – carries the op-amp, supply bypass capacitors and a few other components. A centre-tapped 18V supply – provided from two 9V batteries (Eveready 216 or equivalent) – is required for the amplifier part of the circuit. The current drain for this part of the circuit is about 3mA, or less than 1mA using a TL061.

We estimate that the current cost of components for the project is approximately

$45.00

This includes sales tax but not the cost of batteries.

Excitation

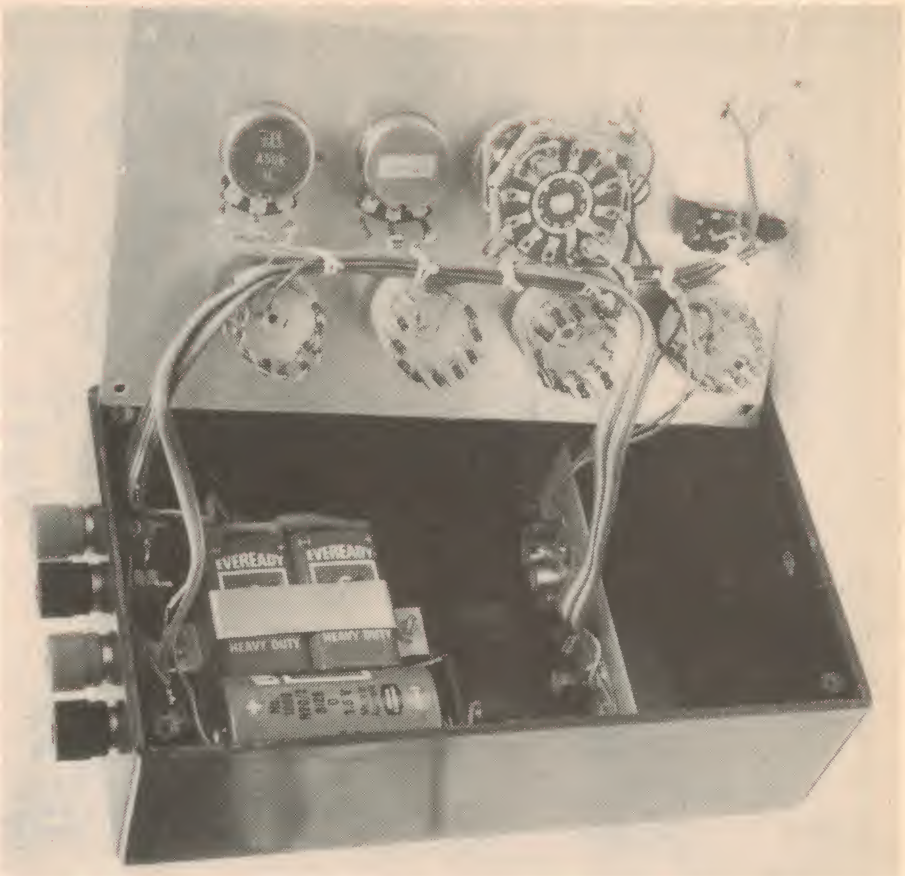
The bridge excitation voltage is provided by a D type 1.5V cell. Under most test conditions, the current in the bridge circuit is negligible. However with the x 0.001 multiplier selected and very low values or RX under test, the bridge current could become excessive. For this reason, a 47Ω resistor in series with the cell limits the current to 30mA.

The meter used for the project should be a small, centre zero type. The particular meter shown in the accompany-

ing photograph has a rating of 200μA-0-200μA, and was obtained from Radio Despatch Service. There are several suitable alternatives, including the centre-zero meter used in the Playmaster FM Tuner and available from Dick Smith Electronics. Meters with less sensitivity may necessitate an alteration to the value of the 10kΩ current limiting resistor in order to achieve the required deflection. If selecting a meter other than the one shown, make sure it will fit into the available space.

The "read' switch is of the momentary contact type. When depressed, it simply connects the 1.5V cell across the bridge. To prevent decade switch transients from affecting the meter, the "read" switch may need to be released each time a new setting is made with very high gain settings.

It should be noted that when extremely low values of RX are used, the leads of RX, the bridge terminal resistance and internal RX wiring resistance can all influence the readings obtained, as they all appear in series with RX. This can readily be seen by referring to Fig. 1, and the error can be established and then subtracted from the dial readings for an accurate result. Most, if not all, low resistance measuring devices suffer from the above problem; in this instrument it is minimised by divorcing RX from switched circuits of any kind. Don't be unduly alarmed by this; bear in mind that RX values of below 0.1Ω are the only ones to be affected.



View inside the completed Wheatstone Bridge, showing how the various components are mounted. We used rainbow cable to make the wiring connections.

Construction

The Bridge is built up in any reasonable case or box which can accommodate the controls on its front panel. As can be seen from the accompanying photographs, it is possible to cram the "works" into the largest size plastic utility box which measures 196 x 113 x 60mm. The only components not mounted on the lid are the PCB, batteries, terminal posts and a separate 47Ω resistor. Start by mounting the PCB components, the IC being the last component to be soldered onto the PCB.

The batteries are clamped to the bottom of the case using scrap aluminium in the case of the two 9V batteries and a battery holder for the 1.5V cell. Snap connectors are used for the 9V batteries. When making the connections to the battery holder, remember the 47Ω resistor in the positive line. This can be soldered to a small tag strip which, in

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turn, is retained by one of the meter mounting screws.

When mounting the rotary switches take the extra trouble to drill locating pin holes to suit your particular switches, the drill size normally being 3mm. File a grub-screw flat on the switch shafts if they are not already machined. This minor extra effort will be repaid by the switches and knobs retaining their original positions for life.

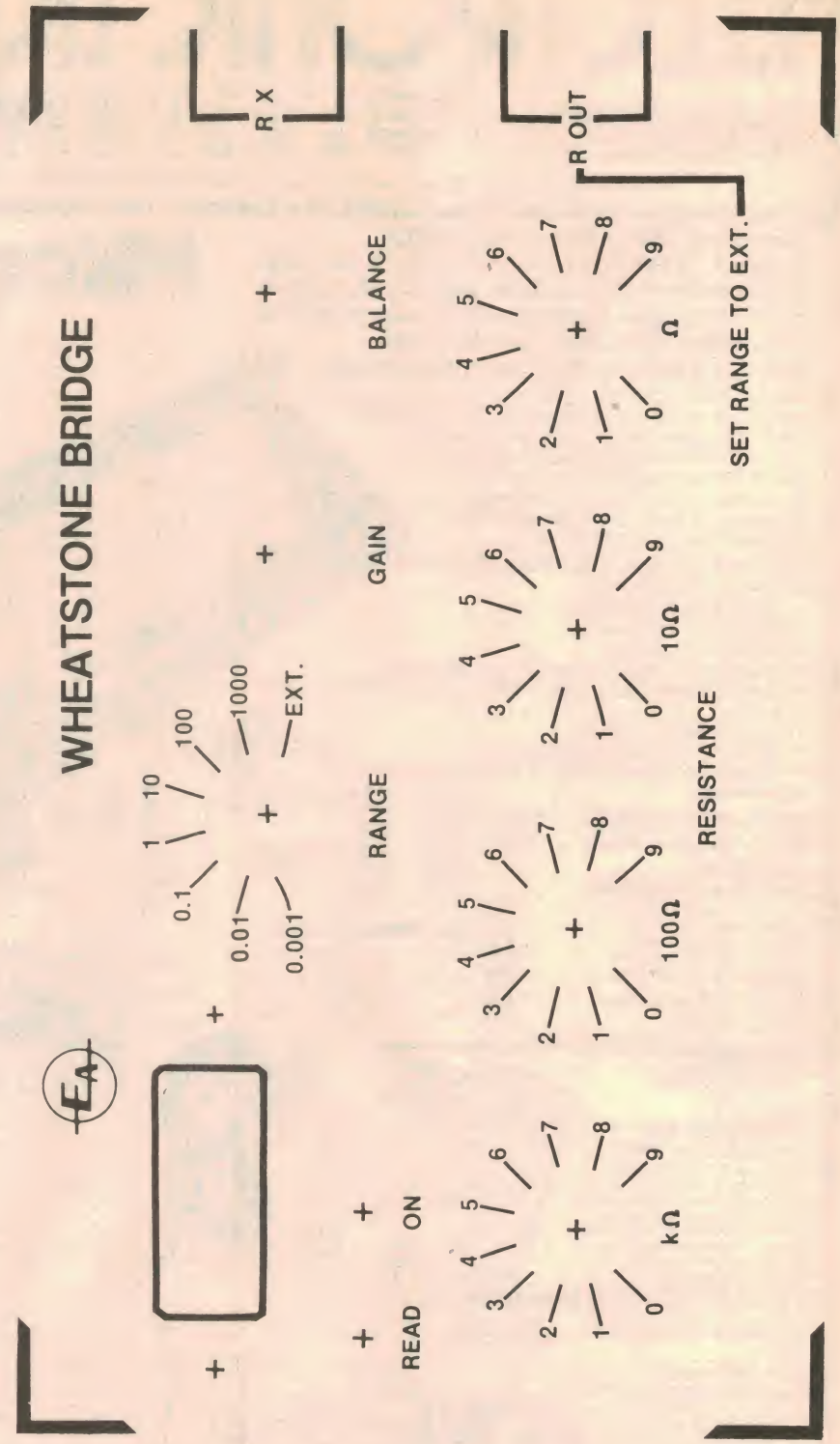
Choose black knobs with white or grey markings to obtain the "test equipment look". If using the Scotchcal front panel designed for the project, all the required numbers and titles are provided. The knobs used on the prototype are quite inexpensive and are available from Jaycar Pty Ltd.

As a matter of convenience, we have used rainbow cable for all the internal wiring, but the accuracy of the × 0.001 range would be improved slightly by using a heavier gauge wire. A suitable choice would be 32 × 0.2mm (or heavier). Good quality binding-post terminals with 4mm sockets are required for RX and the decade box output, permitting the use of standard test leads if desired.

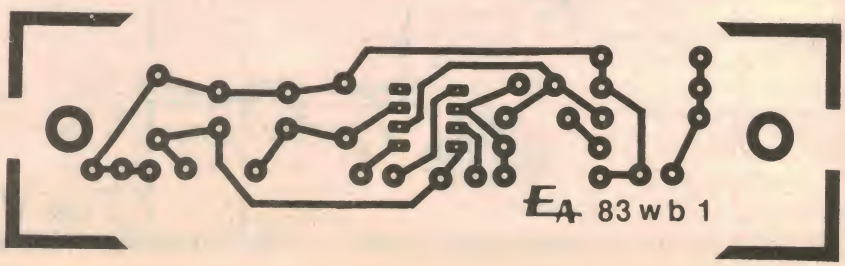
At this point, all fitting and internal wiring should be completed. The resistors and wiring of the multiplier switch in particular should be double checked; in fact re-check all the five-banded 1% resistors for correct values. If you have never handled 1% five-banded resistors before read the following remarks carefully as at least two traps could be your downfall.

(1) All the 1% resistors used in this project, based as they are on decades, commence with the digit one. As the band colour for 1% tolerance is brown, we have therefore a large quantity of tiny resistors with a brown band at each end. The possibility of reading one or more "backwards" is quite high, to say the least. Remember, the tolerance band (five) is always to the right when decoding the colours; the trick is to identify band five, as manufacturers differ in their approach. Some bunch the first four bands towards one end, leaving a wide margin at the band five end, Some simply space out the bands evenly, but use a broader band five. Some bunch the first four bands closely, with a wide gap between four and five. Some use a combination of these various methods, we suggest that you have a good look at all this before switching on, checking with a conventional ohmmeter if you are uncertain.

(2) The multiplier band four is the second pitfall. These five band resistors were introduced as the E48 and E96 series, allowing three significant figures



Here are actual size artworks for the front panel and PC board.



Experience the thrill of building your own speaker system

& SAVE!

with the NEW Playmaster Speaker Kits

Dick Smith brings you two superbly styled speaker systems to suit your room, your decor – and your pocket!
They feature a completely new format and appearance, starting with the strikingly handsome new grilles, featuring the new 'Playmaster' logo.

FROM $333 A PAIR

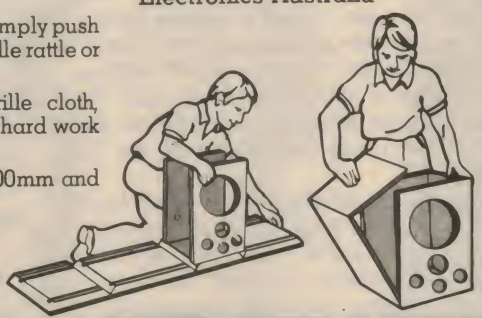
look at these features:

- All-new design in attractive woodgrain finish. They'll complement any decor!
- Separate level controls for high and mid ranges: tailor the sound to suit the listening environment.
- Special speaker sealant material supplied to ensure absolute air tightness.
- New design ribbed woofer with massive 30cm cone for accurate bass reproduction.
- Built-in plinth to raise the speaker off the floor level for minimum audio colouration.
- Manufactured to the exacting standards of the original design published in Electronics Australia magazine.
- Fully imported contoured grilles that simply push into place on special clips: no more grille rattle or movement.
- Acoustically transparent silk-like grille cloth, heat welded to support frame. All the hard work is done for you already!
- Your choice of two different sizes : 300mm and 250mm systems.

Designed by:
Neville Williams MIREE (Aust)
Editor-in-Chief,
Electronics Australia

& see how easy they are to build!

It's so easy – all it takes is a couple of hours of construction time – and you save a fortune on comparable built up speakers. And as the photo above proves, they're as good looking as any speakers you'll find in the hi-fi showrooms.
And just imagine being able to say . . .
'I built them myself.'



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250mm SPEAKER SYSTEM	
250mm Speaker Grille (C-2610)	$35.90
250mm Enclosure Kit (C-2634)	$148.10
250mm Speaker Kit (C-2044)	$149.00
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Complete 300mm Kit	$360 per pair

THIS AMAZING VALUE ONLY FROM

DICK SMITH Electronics

A416M/LM

SEE PAGE 98 FOR ADDRESS DETAILS

TABLE 1

Multiplier settings for maximum accuracy.

RX	OHM/STEP	MULTIPLIER
Below 9.999Ω	0.001	× 0.001
10 – 99.99Ω	0.01	× 0.01
100 – 999.9Ω	0.1	× 0.1
1k – 9.999kΩ	1.0	× 1.0
10k – 99.99kΩ	10	× 10
100k – 999.9kΩ	100	× 100
1M – 9.999MΩ	1000	× 1000

TABLE 2

How incorrect multiplier settings decrease read-out accuracy.
RX = 1.394 – Recommended Multiplier × 0.001.

× 0.001	1.394	4 Significant Figures
× 0.01	1.39	3 Significant Figures
× 0.1	1.4	2 Significant Figures
× 1	1.0	1 Significant Figure

to be indicated by bands one, two and three. Band four, which is the multiplier, therefore has one extra digit to its left. This means that a red band seen here gives a value 10 times higher than you might expect from your previous experience with RMA coded resistors (normal 5, 10 and 20% types). To eliminate this troublesome extra zero we drop downwards one multiplier colour, ie yellow becomes orange, orange becomes red etc. The actual colour code is not changed but it is the extra significant figure which upsets the apple-cart.

If all this leaves you feeling confused, here are the colour bands which will be on each of the resistors: S2, 1kΩ (1%) – Brown, Black, Black, Brown, Brown; S3, 100Ω(1%) – Brown, Black, Black, Black, Brown; S4, 10Ω(1%) – Brown, Black, Black, Gold, Brown and S5, 1Ω (2%) – Brown, Black, Gold, Red. This should help to clarify the position. It is actually quite logical, but the knowledge of the old code throws you!

Check out and testing

If everything appears satisfactory, set the mechanical zero on centre scale – your meter may or may not make provision for this – connect up the batteries and switch on. With the gain control at minimum a small deflection may be seen, reducing to zero with correct setting of the "balance" control. Advance the gain control and check the setting at several points, noting as you go that increased gain means more critical zero setting. It follows therefore that you should use the lowest gain giving you a reasonable deflection, stability and drift then being excellent. The instrument is now ready for use, no further calibration being required.

Connect a resistor of known value to RX terminals, and switch on. Check zero set and advance the gain control to say, 9 o'clock. Set the multiplier to the range appropriate for the test piece, as found from Table 1 at the top of the page. It obviously helps if the approximate value is known, as a certain amount of blind fumbling (commonly referred to as trial and error) can thus be avoided.

Depress the "read" button and vary the decade knobs, working from left to right until the meter reads zero. While working towards this zero condition the "kΩ" knob (S2) is set to give a reading on the left or low side of the scale, the "100Ω" knob (S3) is set to give a closer reading on the same side of the scale, and the final balance adjustments made on the "10Ω" knob and then finally on the 1Ω knob.

You should now be able to read, from left to right, a four figure dial number such as 1 2 3 4 which combines with the multiplier setting to give the result, merely adding zeros or positioning a decimal point as may be required, eg:

1234 × 100 = 123400
= 123,400Ω or
123.4kΩ.

The gain control can be advanced to increase sensitivity as the final balance point is approached, or if high values of RX are being determined. Having successfully completed this preliminary canter over the course with a known value, try your hand with a few unknown values and get the feel of the instrument.

Table 1 is a list of multiplier settings for maximum accuracy. Table 2 demonstrates how incorrect multiplier settings decrease the number of significant figures in a measurement.

PARTS LIST

1 3-way tag strip
7 knobs to suit
4 terminal posts, two red, two black
1 200-0-200μA centre-zero meter
1 plastic utility box, 196 x 113 x 60mm
1 Scotchcal front panel
1 printed ciruit board, code 82wb12, 106 x 28mm
2 9V type 216 batteries with snap connectors
1 D-size 1.5V cell with holder
4 rubber feet

SEMICONDUCTORS
1 LF351, CA3140, TL061 operational amplifier
2 OA90 germanium diodes

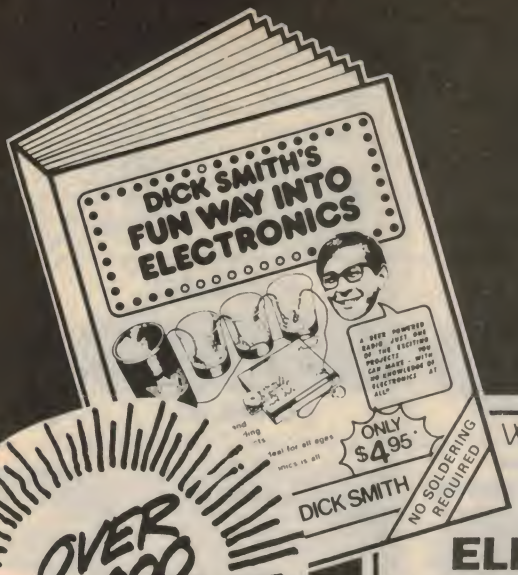
CAPACITORS
2 100μF/10VW electrolytic
1 4.7μF/10VW non-polarised electrolytic
2 0.1μF metallised polyester (greencap)

RESISTORS (¼W, 1% metal film unless noted)
2 x 100kΩ, 3 x 10kΩ, 13 x 1kΩ, 11 x 100Ω, 9 x 10Ω, 1 x 47Ω 5% ½W cracked carbon, 9 x 1Ω ¼W (lowest tolerance available), 1 x 500kΩ log potentiometer, 1 x 50kΩ linear potentiometer

SWITCHES
4 single-pole 12-position rotary switches
1 2-pole 8-position rotary switch
1 SPST momentary contact push button
1 DPST on/off switch

MISCELLANEOUS
Scrap aluminium (95 x 15mm), machine screws and nuts, rainbow cable etc.

GET INTO ELECTRONICS FOR $4.95



OVER 30,000 SOLD!

WITH DICK SMITH'S

FUNWAY INTO ELECTRONICS

This is the top selling Fun Way Into Electronics Vol. 1 that has proven that electronics can be fun. For the raw beginner, this book introduces 20 exciting projects that can be built by using a unique 'breadboard' construction system - no soldering, so it's safe. Each project is fully illustrated so that mistakes are virtually impossible. This top-selling book is now into it's fourth printing proving just how popular it has been. Don't miss out! Cat B-2600

ONLY $4.95

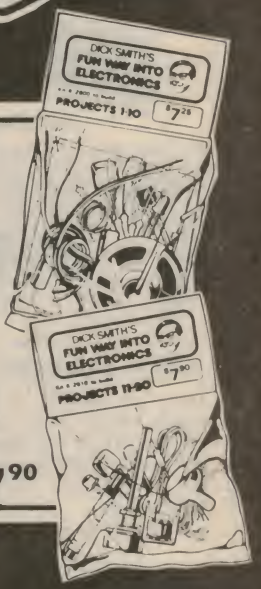
Vol 1 KITS

Kit to build projects 1-10

You can build any of the first ten projects from 'Fun Way Into Electronics' with this kit. It even includes the base board on which you assemble the circuits! Cat K-2600 $7.25

Kit to build projects 11-20

This kit contains the slightly more specialised components which, together with the components from kit 1, will enable you to make any of the projects in the book. Cat K-2610 $7.90



PARENTS PLEASE NOTE

All Fun Way Into Electronics kits are battery powered so they are completely safe. Also, Fun Way Vol. 1 kits require no soldering.

FUNWAY VOL. 2 20 MORE PROJECTS

After mastering Fun Way Vol. 1 what better way to go than Vol. 2. In Vol. 2 you are introduced to printed circuit boards and soldering. Both are fully explained and illustrated and they give you the choise of making your own boards or buying ready made. The basic laws of electronics, plus chapters on component codes, assembly hints etc. are fully explained. ..... Cat. B-2605 $6.95

FUNWAY VOL 2 KITS FROM $2.95

MULTI-PURPOSE LED FLASHER $2.95
A really simple kit that can be used as a warning device, electronic jewellery, etc. Cat K-2621

DING DONG DOORBELL $4.50
Welcome visitors to your home with this integrated circuit doorbell! Cat K-2622

MORSE CODE TRAINER $4.50
This simple oscillator circuit lets you learn Morse code the easy way! Cat K-2623

UNIVERSAL TIMER $5.50
Use it as an egg timer, a darkroom timer, etc. In fact, it's got a lot of applications! Cat K-2624

ELECTRONIC DICE $4.95
Throwing a dice is old hat, do it electronically! Simple circuit has other uses too. Cat K-2625

MONOPHONIC ORGAN $7.95
Easy to build, and easy to play! And it even has 'vibrato' – just like the big ones! Cat K-2626

POCKET TRANSISTOR RADIO $7.95
Simple to build, and it's nice and small. Listening is so much more fun! Cat K-2627

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One touch on, next touch off – or on while touched. Dozens of uses in the home. Cat K-2628

MOSQUITO REPELLER $4.95
Don't get eaten by mozzies, scare them away electronically. Take it anywhere. Cat K-2629

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A useful little amplifier for all those projects needing audio amplification. Cat K-2630

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A simple BFO circuit you can use to find metals, pipes, wiring, etc – maybe gold! Cat K-2633

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Learn how burglar alarms work when you install your own! For home or car. Cat K-2635

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Great for alarm use – or where any warning is required. Good for kids toys, too! Cat K-2636

LED LEVEL DISPLAY $8.95
This fascinating project shows you the audio level of any amplifier. Cat K-2637

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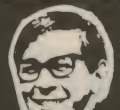
Communicate! Build this intercom and talk between rooms, etc. Cat K-2638

LED COUNTER MODULE $7.95
Learn how digital circuits work by building a counter. Count slot car laps, etc. Cat K-2639

SHORTWAVE RECEIVER $6.95
Listen in to the exciting world of shortwave radio amateurs, foreign countries! Cat K-2640

SCHOOLS, RE-SELLERS, ETC.:
We'll negotiate a special price for bulk quantities on either books or kits, or both!

DICK SMITH ELECTRONICS



SEE PAGE 98 FOR ADDRESS DETAILS

A383/CT

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA. Ph (03) 489 8131. Telex No. 38897

BOGGLE GOGGLES

$9.60

Short form

PH METER

$115

Driveway Sentry

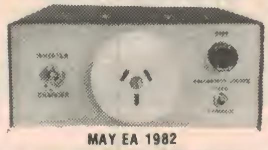
$32

Tacho/dwell meter with digital display

$62

MAY EA 1982

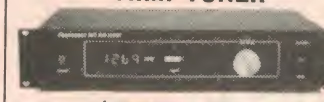
12/240 volt Inverter 40 WATTS



$49.50

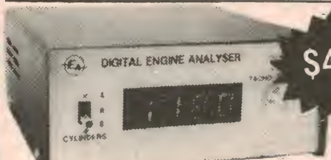
MAY EA 1982

A.M. TUNER



$239

(complete kit)



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Engine Analyser Kit

Eprom Programmer

$55.00

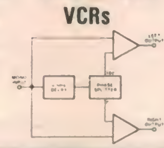
JANUARY EA 1982 INCLUDES TEXTOOL SOCKET

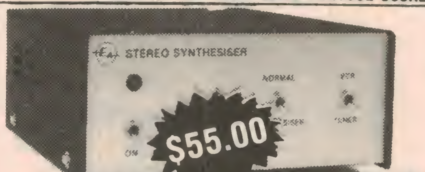
$189.00

Analogue and Digital Storage CRO Kit

STEREO SYNTHESISER FOR TUNERS AND VCRs

Enjoy the benefits of stereo sound from your video cassette recorder, TV or AM tuner with this Stereo Synthesiser. The circuit uses just four ICs and is easy to build.





$55.00

SEPTEMBER EA 1982

Duel Tracking Power Supply

$83.50

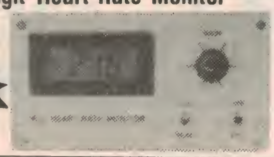
REMOTE INFRARED TV SOUND CONTROL

$40

Portable 3½ Digit Heart Rate Monitor

JULY EA 1982

$79.00



100w Sub-Woofer Amplifier

$85.00

JULY EA 1982

EA POWER UP

$33

EA NOV 1982

Led Head Lightchaser

(Battery and headband extra)

$12

PLUG PACK REGULATOR

$14

Plugpack Extra

EA DIGITAL READOUT FOR SW RECIEVERS

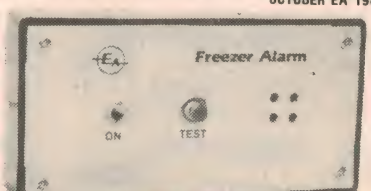
$72.00 COMPLETE

OCTOBER EA 1982

EA EASY-TO-BUILD FREEZER ALARM

$21

OCTOBER EA 1982



EA ELECTRONIC STARTER FOR FLUORESCENT LAMPS

$5

OCTOBER EA 1982

EA GUITAR BOOSTER

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EA THEREMIN $34.50

JUNE EA 1982

OVER 200 NOW SOLD

EA INVERTER $195

INCLUDING TRANSFORMER 300 WATTS

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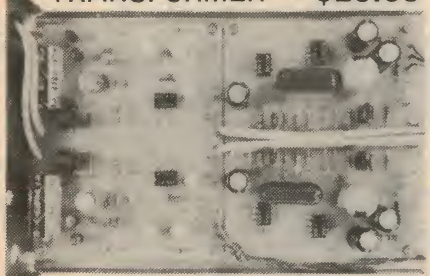
P & P $10.00 Anywhere in Australia

Minimum P & P $3.00 for kits

ROD IRVING ELECTRONICS

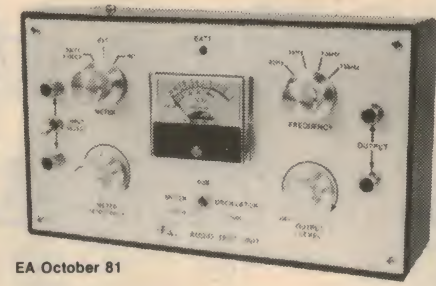
425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA. Ph (03) 489 8131. Telex No. 38897

MIXER PREAMP TRANSFORMER $26.50



Easy construction and versatile operation, this Preamp was for coupling with the 300W "Brute" Power Amp. **ETI 467 July 80**

AUDIO TEST UNIT FOR CASS DECKS $47.50

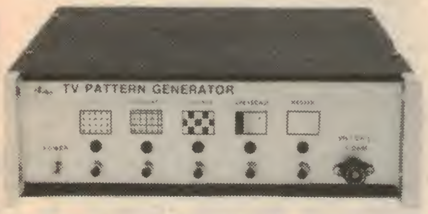


EA October 81

CRYSTAL MARKER (INC 1MHZ X) $34.50

ETI 157 October 81

TV PATTERN GENERATOR $57.50

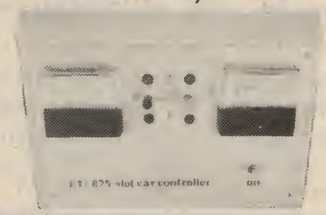


Adjust your TV for a first-class picture with EAs crystal controlled TV Pattern Generator. **EA June 80**

BIPOLAR TRAIN CONTROLLER $28.50

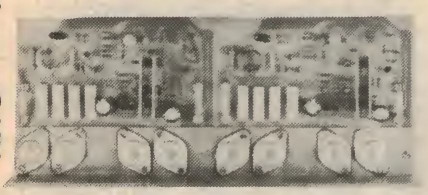
EA December 80

SLOT CAR POWER CONTROLLER (WITHOUT CASE) $70.00



ETIs Slot Car Controllers will put more zip in your slot cars zap. Plus Power Supply as indicated. **ETI December 81.**

ETI 477 MOSFET MODULE $58.50



Remember the great ETI 5000 power amp. With this module as the hub of the ETI 5000 and a transformer you get an amazing power output of 150W RMS.

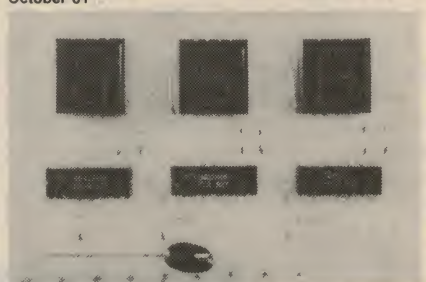
Plus Power Supply (No Trans)	$49.00
Plus Transformer	$39.50

PC BIRDIES $14.50

Granny's Birthday – PC Birdies.
Grannys got a birthday coming up and you don't know what to give her! Her cat ran away, her dog starved and the fish turned upside down. Well here's the perfect gift. A no-nonsense, no maintenance companion. The PC Birdies — She'll whistle, sing and dance for hours to this amazing electronic canary. **EA May 81**

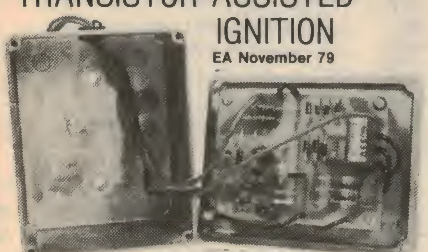
DIGITAL COUNTER DISPLAY $13.50

HE 114 HOBBY ELECTRONICS October 81



TRANSISTOR ASSISTED IGNITION $32.50

EA November 79

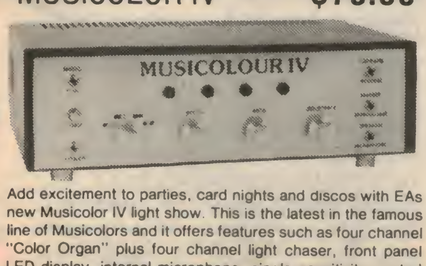


WIND SPEED INDICATOR $43.50

October 81

ETI 50W MODULE $17.50
ETI 100W POWER AMP $22.00
VERSATILE EPROM CARD $115.00
MOVING COIL PREAMP $24.50
MOVING MAGNET PREAMP 18.50
DREAM 6800 $109.00
445 STEREO PREAMP $8.25

MUSICOLOR IV $79.00



Add excitement to parties, card nights and discos with EAs new Musicolor IV light show. This is the latest in the famous line of Musicolors and it offers features such as four channel "Color Organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety. **EA August 81**

ETI SERIES 5000

Power Amp $299.00
Pre Amp $259.00

The MicroBee low cost personal computer

A revised version of the Applied Technology Microbee computer has just been released and is now available from selected retailers throughout Australia. A feature of the new computer is an extensive array of software available in EPROM.

by PETER VERNON

Our first impression of the Microbee was that it was a compact, neatly presented unit. The case is moulded in white and grey plastic, with overall dimensions of 350 x 230 x 58mm (W x D x H) – not much bigger than some machines being promoted as "hand-held" computers. It would fit nicely in a briefcase, with room to spare.

Keyboard and video

The Microbee keyboard has 60 full-travel keys, again in grey and white, and is acceptable, if nothing fancy. Undoubtedly it is well suited for the hobbyist or occasional user, although it remains to be seen how the switch contacts hold up under extensive use in a word processing application, for example. At high typing speeds the keyboard produces a rattling sound which may be disturbing to bystanders.

The keyboard is normally in a typewriter mode, generating lower case characters, with upper case accessed by the Shift key. Pressing "Lock" however, reverses this format for alphabetic characters only. In this mode upper case letters are generated with lower case produced by Shift. This arrangement is very convenient for program entry, and an unexpected bonus in a low-cost system.

The video display is a rock steady 64 x 16 lines, and the 6545 programmable video generator can be programmed for other formats, such as 40 x 24, or 80 x 24, although no details of how to do this are given.

Characters are formed in an 8 x 16 block, rather than the more usual 8 x 8 pixels. The resulting characters are tall and narrow. Because of the design of the character set there is almost no horizontal separation between some adjacent characters, making the screen hard to read at times.

On the plus side, the character set has true descenders and has no "vertical compromises" to give these descenders. This is probably one of the reasons that the Microbee was approved for use in schools by the NSW Education Department.

In addition to upper and lower case alphanumeric characters the Microbee has four display modes; underline, inverse, low resolution graphics and high resolution graphics. Low resolution is 128 x 48 pixels and can be mixed indiscriminately with text. High resolution is 512 x 256 pixels and can be mixed with text with some restrictions. Activating the high resolution mode clears the screen, but alphanumeric characters can be printed after the completion of a high resolution drawing.

Inverse and underline characters are mutually exclusive – the display can be either one or the other. These two attributes are not available on a character-by-character basis – typing "UNDERLINE" for example, means that every character is displayed with an underline until the display is restored by typing "NORMAL".

When none of the graphics or character attribute modes are in use the programmer can access 128 programmable character blocks held in RAM to create unique graphics patterns or alternate character sets. It is these programmable blocks which are used to create the high resolution graphics, and this approach does have some limitations.

The Applied Technology MicroBee computer is supplied with a 12VAC plugpack power supply, manual and demonstration cassette. Plugs at front are for cassette recorder.

A program incorporated in the Basic Interpreter determines which pixels of the character cell need to be illuminated and where the character must be placed on the screen to create the display required. The same program keeps track of how many of the 128 programmable characters have been used and which of these can be over-written as more of the screen is filled.

As long as displays are confined to vertical and horizontal lines this method works well. Diagonal lines exhaust memory space more quickly, and circular patterns or complex, full screen graphics are not possible.

Internal details

Opening up the MicroBee reveals two circuit boards, the upper containing a mixture of RAM and ROM and the lower carrying the Z80 microprocessor, video display circuitry, cassette interface, tone generator, keyboard and interface connectors.

A standard Microbee has 16K of programmable memory, with room for on-board expansion to 32K. The other half of the memory board has space for up to 28K of ROM. MicroWorld Basic occupies 16K, with the remaining space available for utilities such as an editor/assembler, network communications program or a word processing package. Our review machine contained the word processor (of which more later).

A feature of the Microbee is its use of CMOS memory which draws very little current. A 4.5V camera battery provides sufficient power to allow the memory to be maintained on standby while the mains supply is off. The program in memory is retained, whether the user wants it or not.

An RS-232C interface is provided for connection of a printer or other serial device. Two other openings at the rear of the case provide access to the circuit board, which is pre-drilled to allow addition of an expansion connector for the Z80 bus and parallel interface circuitry. A parallel port can be added by installing a 25-pin D-type connector and a single integrated circuit.

One of the reasons why the Microbee is so compact is that it has an external power supply in the form of a 12VAC plugpack. This feeds rectifiers, filters and three 5V regulators in the Microbee. As such, this arrangement could be improved upon. For a start, the plugpack voltage of 12VAC means that a relatively high DC voltage is fed to the regulators, leading to higher than necessary power dissipation in the case.

High resolution (512 x 256) graphics displays can be over-printed with text as shown here. The incomplete design results when all programmable characters have been used.

And it would seem that when the Microbee is fully optioned up, the power supply is not quite up to the task. While some owners have gone to the trouble of building a more rugged external supply it would seem that these problems could be overcome by providing a plugpack with a lower output voltage and a higher current rating, ie, with the same overall power rating.

Power is supplied to the Microbee from the 12VAC plugpack with a 5-pin DIN connector. The same connector is also used for the cassette interface connections and direct video output. There is no RF modulator, so attempting to connect the computer to a standard television set is doomed to failure.

The manual accompanying the machine makes no mention of the need for a direct entry video monitor. In the same fashion it is not until page 124 of the 144 page booklet that instructions are given for connecting a cassette recorder – and even then the manual refers to a red plug which is actually grey. Considering that a demonstration tape intended for classroom use was included with the computer, this is a serious failing.

All in all, the manuals supplied with the Microbee suffer from the common failing of those written by someone too close to the subject. Features not commonly used are treated in loving detail while vital information for the beginner is either glossed over or missing entirely. At the time of this review an extensive re-writing of the manuals was underway, so these comments may not be ap-

MicroBee specifications

Processor: Z80
RAM: 16K, expandable on-board to 32K, with battery back-up
ROM: 16K, expandable on-board to 28K
Interfaces: RS232C serial port, optional parallel port and S-100 expansion.
Keyboard: 60 keys including spacebar, typewriter style
Display: 64 x 16 upper and lower case, underline and inverse video modes
Graphics: High resolution, 512 x 256 using programmable characters Low resolution 128 x 48
128 programmable characters, 8 x 16 pixel matrix
Sound: 25 tones with duration in increments of ⅛ second.
Expansion: 64K memory version, S-100 interface, disk drives
Editor/Assembler, word processor and network communications software is available in ROM
Documentation: Incomplete at time of writing.

plicable to the final versions of the manuals.

Basic programming

Microworld Basic, supplied with the Microbee has a strong resemblance to the Basic of the Super-80. This is not surprising since both are based on Basic ETC, originally supplied by East Texas Computers and written by John Arnold and Dick Whipple, the co-developers of the original Tiny Basic.

Microworld Basic shows its Tiny Basic heritage, particularly in the use of single letter variable names and restrictions on mixing variables of different types.

Perhaps the most confusing point for new users of Microworld Basic is the restriction on variable names. There are a number of rules which must be observed.

Firstly the type of variable is indicated by its name. A numeric variable is represented either by a single letter, for integer values or a letter followed by a number between 0 and 7 for real number values. A string variable consists of a letter, a number from 0 to 7 and a $ sign. Variables are distinguished by the first letter part of the name, so A0 and A0$ cannot both be used in the same program as Basic will not recognise them as different variables.

Mixing integer and real variables in the same expression will result in an error message. The Statements PRINT A1 + B or PRINT C + D0 will cause this error because of the combination of integer and real variables.

This peculiarity has more subtle effects as well. The following program;

```
10 A=3
20 PRINT A/2
```

will return 1, not 1.5. Division of an integer always returns an integer result.

Two statements are provided to get around the problem. INT converts a real value into the next lowest integer, while FLT does the reverse, converting an integer into real number format so that it can be combined with other real number values.

String handling is another major difference between Microworld Basic and Microsoft. In many ways the Microworld string statements are more flexible, and are certainly more consistent in format. A single reference to a string of characters combined with the appropriate parameters can do the same duty as Microsoft's LEFT$, RIGHT$ and MID$.

For example the following program reproduces all three functions;

```
10 A1$="ABCDEFGH"
20 PRINT A1$(;1,N):REM PRINT THE
FIRST N CHARACTERS OF A1$
30 PRINT A1$[;LEN(A1$)-N+1,
LEN(A1$)]:REM PRINT THE LAST
N CHARACTERS
40 PRINT A1$(;N,M):REM PRINT THE
CHARACTERS FROM POSITION N TO
POSITION M
```

Also unusual is the presence of a SEARCH statement. This statement searches a designated string for the occurrence of a specified substring, and returns the position at which the substring is found (or zero if the search is unsuccessful). An example will make this clearer;

```
A0$="ABCDEF"
PRINT SEARCH (A0$,"DEF")
```

This example will return 4, the position of the start of the substring "DEF".

On a more general basis, the command GX activates a global search and replace function which will locate a specified series of characters and replace them with another set of characters. It is an editing command, and very useful for correcting errors which occur throughout a program.

Although similar to Super-80 Basic, MicroWorld Basic is more extensive, as indicated by the additional 4K of ROM required to contain it (Super-80 Basic is a 12K version). MicroWorld Basic adds extensive error handling statements, including ON ERROR GOTO and ERRORL (which returns the line number at which the last error occurred). Error messages are explantory text, rather than cryptic code numbers, and an arrow is displayed at the approximate position of the error.

Another valuable feature of this version of Basic is the capability to re-direct input and output. Basic statements are provided to allow output that would normally be displayed on screen to be sent to a printer, cassette recorder or RS-232C device such as a modem. Input data can similarly be taken from the keyboard, cassette recorder or the RS232C interface.

Activating a printer connected to the parallel port is simply a matter of typing;

```
OUT#1 ON
```

Cassette operation can be at one of two speeds, either 300 baud or 1200 baud, and file names can be up to six characters long. All file names are displayed as the Microbee searches the cassette tape and a LOAD? command is provided which allows a program on tape to be compared with a program in memory. Given this array of cassette operating facilities it is unfortunate that no provision has been made for direct computer control of the cassette recorder.

Automatic line numbering is provided by the AUTO command, and programs can also be re-numbered on command. In combination with the ability to accept input from the cassette recorder as if it was typed from the keyboard this facility allows a program on tape to be merged with a program held in memory.

Graphics abilities

MicroWorld Basic provides an extensive series of statements to make use of the graphics capabilities of the computer. The PLOT statement, available in either high or low resolution allows lines to be drawn on the screen by specifying the start and end points. Lines can also be erased with PLOT R, or inverted by adding "I" to the statement.

Inversion, in this sense, means that any points on the line which are illuminated will be erased while points which are currently off will be turned on. The SET statement allows individual points to be turned on; RESET is provided to erase a point. An "H" following the SET statement will place the origin of the graphics co-ordinates at the top left hand corner of the screen rather than its usual position at the bottom left.

While the graphics capabilities are extensive and the high resolution mode impressive, a considerable amount of screen flicker is evident while these statements are being executed. Apparently no attempt has been made to synchronise memory accesses by the CPU and the video display generator.

The result is that the CPU updates memory at the same time as the display generator is attempting to read the current contents for display, and the conflict causes a series of black lines on the

MicroWorld Basic statements and functions

ABS ASC ATAN AUTO CHR$ CLEAR CLS CONT COS CURS DATA DELETE DIM EDIT END ERRORC ERRORL EXEC EXP FLT FOR . . TO FRACT FRE GOSUB GOTO GX HIRES IF . . THEN IN IN# INPUT INT INVERSE KEY$ LEN LET LIST LLIST LOAD LOG LORES LPRINT NEW NEXT NORMAL ON ERROR ON . . GOSUB ON . . GOTO OUT OUT# outl OUTL# PCG PEEK PLAY PLOT POINT POKE POS PRINT PRMT READ REM RENUM RESET RESTORE RETURN RND RUN SAVE SD SEARCH SET SGN SIN SPC SPEED SQR STEP STOP STR STRS TAB TRACE UNDERLINE USED USR VAL VAR ZONE

screen as graphics statements are carried out. The Microbee is excellent for generating static pictures, but any attempt at animated scenes is likely to cause disappointment.

Limited sound capabilities are also provided by the Microbee. The PLAY statement will sound one or more notes from an internal speaker, with a duration specified in increments of ⅛ second. Twenty-five possible notes can be generated, covering a frequency range of 220Hz to 831Hz (almost two octaves).

Sounds are produced directly by the microprocessor, interrupting the execution of other program statements for the duration of the sound.

There have been reports of "bugs" in MicroWorld Basic, possibly as a result of the continuous memory feature. Even a cold start does not clear out memory, and bad values can remain from a program gone awry. This results in mysterious errors which show up when a program is listed, and remain in spite of attempts to correct the offending line.

Perhaps some of these problems could be solved by adding a switch to disconnect the battery backup and thus ensure a truly cold start.

Representatives at Applied Technology stated that investigations into these problems are continuing, and that any Basic bugs will be corrected.

High resolution display which also shows the programmable characters that have been used to build up the design. White areas are inverse video characters.

Wordprocessing on the MicroBee

The version of the MicroBee reviewed here was supplied with word processing software built in. Called "WordBee", this the program is contained in a set of ROM chips and when combined with the battery back-up for the MicroBee's memory produces a very powerful and unusual word processing system.

It should be noted that the version of WordBee we received was a sample only, and the program was not then advertised by Applied Technology. This aside, "WordBee" shows great promise.

The author of the program and the preliminary manual which accompanied it makes no secret of the fact that WordBee has features of several of the most popular word processing systems, with screen formatting and menu displays reminiscent of "Electric Pencil" (tm), a "Help" command as in "Word Master" (tm) and dot commands embedded in the text for printer control as in "WordStar" (tm).

Whatever the inspiration, however, WordBee is an impressive program. It is menu-driven, with extensive prompts and operating guides available at any time.

Because it is ROM, co-resident with MicroBee's Basic, the word processing program is available for use at any time. Battery-powered memory means that word processor files can be retained even when the power is switched off. The result is a word processor that can be used anywhere a video monitor is available. Files can be entered into memory and edited and then printed out at a later date.

WordBee is entered from Basic by typing "EDASM" – apparently this command accesses the ROM address space, and the first program to be supplied for this space by Allied Technology was an Editor/Assembler. On entry the first menu is displayed and the MicroBee is in the "interface" mode. This mode is used for switching between control menus and text, saving and loading files from tape and checking file status.

A nice feature is the word count function which returns the number of words in the text file. File status can also be found, returning the position of the cursor in the file, the total length of the file in characters, the number of characters which can be added to the file remaining memory space and total memory space (30462 bytes in a 32K system).

Automatic word wraparound at the end of each line is provided, as is auto key repeat.

Using the editing functions is fairly easy, although few of the single letter Control commands bear any relationship to the actions they invoke. Control-E for example, moves the cursor up one line, while Control-U is not currently used. Control-B activates the block mode, while Control-C scrolls the file towards the beginning. Control-D moves the cursor left, while again Control-L is not used. All in all, 22 Control-key commands are provided.

The Block command (Control-B) and the Find function (Control-F) activate their own sub-menus, which in the first case allows the user to copy, delete and move marked blocks of text around in a document, and in the second allows specified words to be searched for and, optionally, replaced, either on a continuous or case-by-case basis.

Print formatting commands are equally extensive. Printer control functions are indicated by "dot" commands embedded in the text. Functions available include justification, double spacing, line and page length specifications, and page headers. The user can also specify whether a line feed is to be sent after a carriage return, the number of line feeds to be sent at the end of a page and Escape code sequences to control special features of a particular printer.

As supplied, WordBee is set up to use an Epson MX80 or equivalent printer with a serial interface. Neither the Microworld Basic manual or the

continued on p.108

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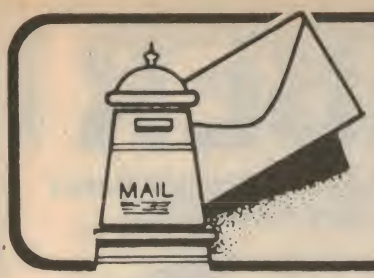

Letters to the editor

Unemployment: a waste of talent

I am grateful to Electronics Australia, and to Professor Blatt, for the article, "Will Robots take your Job?" (December, 1980), and would appreciate a small space in your magazine to comment.

It is highly evident that the philosophies and concepts pertinent to the changed environment thrust upon us are already well advanced, although little as yet has come into the public domain for proper debate. Towards that end I would like to put several arguments regarding the current situation in support of Professor Blatt.

Looking at the situation described in which people are employed where they are not necessarily required in order to maintain levels of employment, it is increasingly the situation in which the difference between employment and useful work is vague and inconsistent. The trauma associated with unemployment results not so much from the loss of the "job", but the loss of the associated level of income.

Correspondingly we have ever larger numbers of people on the dole who not only do not work, they cannot through lack of available resources. The whole of their dole income goes toward finding adequate food and shelter, with none remaining by which their lives may be more constructive and contributive in the community. In both situations the waste of talent and ability is extraordinary.

G. Hardwick,
Dandenong, Vic.

Import statistics & projector market shares

The statement on page 37 of your October issue concerning Hanimex's claimed 76% share of the 16mm projector market has come to my notice.

Only if one totally ignores the import of projectors under security that are not included in the Bureau of Statistics figure under Item 90.08.290/0231 can one come to such a conclusion during certain times of the year. On that basis, Bell & Howell could claim over 70% of the "market" in the September 1982 quarter.

As any importer knows, imports are not a reliable basis for market share estimates, and from trade sales statistics drawn from information submitted by, among others, both Hanimex and Bell & Howell it can be shown that Hanimex's market share in the 1981/82 period was closer to 50%. This is a creditable performance but with two leading makes sharing most of the Australian market, not very surprising.

In view of the considerable discrepancy in these figures I believe it would be in the best interests of all concerned that this letter be published in the next available issue of "Electronics Australia".

K. R. Jones,
A.V. Communications Division,
Bell & Howell Australia Pty Ltd.

COMMENT: the figure quoted in October was based on import statistics from March 1981-82, and did not cover projectors imported under security.

Historical radio society

The Historical Radio Society of Australia was formed last April, with the aim of assisting members interested in the preservation and restoration of early radio and associated equipment, and the collation and interchange of relevant information. We have informal arrangements for interchange of information with the Antique Wireless Association of Holcomb, New York, the British Vintage Wireless Society and the New Zealand Vintage Radio Society.

We now have 74 members in all states of Australia plus NZ and UK and produce a quarterly newsletter. If you feel disposed to mention our existence in your magazine, I would be happy to answer all enquiries.

Ray Kelly, Secretary,
Historical Radio Society of Australia,
49 Sharon Rd,
Springvale, Vic 3172.

What about an S-100 computer?

I must congratulate your magazine for bringing a wide and excellent selection of projects to the average constructor. However, there is one very ignored area, which is at the forefront of research and development, that seems to be overlooked even by your fine magazine – I am sure that many readers will agree with me here.

Now to understand what on Earth I am going on about – the ignored area is an article on how to put together a personal home computer using S-100 boards (readily and relatively cheaply available) using a 16-bit microprocessor. If EA would publish an article on how to put together an S-100 system, I am sure many readers dissatisfied with the popular micros on the market would find such a system unbelievably power-

Comment on the November editorial

Your November 1982 editorial regarding Australian manufacture of loudspeakers to the theories of A. N. Thiele and Dr Richard Small certainly strikes a sensitive spot with this organisation. However, let me say that we don't just stop at their theories. The many conflicting parameters that involve design and manufacture of a good loudspeaker system are difficult enough, but in this country we are blessed with having not one but two of the most highly regarded engineers in the world, right on our doorstep. (Dr Small was recently awarded the silver medal of the Audio Engineering Society of America.)

Hence, we don't just use their theories. The direct assistance given to me personally by both Neville and Dick with the bass-end alignments of all our loudspeaker systems is much appreciated.

Yes, we agree that our larger speakers should be on stands for good natural bass reproduction, as mentioned in your review of our 8066s.

Now the second count – fancy not knowing that we produce an AM/FM tuner with a hifi AM section. We certainly feel that with its low-noise balanced antenna system, (pioneered by us in 1970 – see EA May '71), 13kHz AF response, and stereo simulation, it will give even your fine tuner a run for its money, though at $760 at least it is fully built and guaranteed.

Perhaps one day, when we have enough dealers to handle our Australian products we may even advertise.

Ron Cooper,
Audiosound Laboratories,
148 Pitt Rd,
North Curl Curl, NSW, 2099.

COMMENT: We are sorry we were unaware of your AM/FM tuner. We wonder how many others were similarly unaware.

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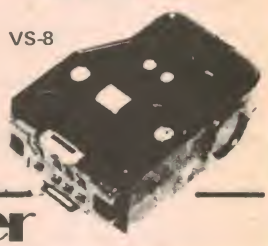

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					UHF	4	20	1.7
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ful and good value, as they can choose the languages (eg Pascal, FORTH, BASIC, etc) they want on it and whatever hardware configuration they like.

K. Fong,
St Lucia, Qld.

Watch out for pink capacitors

Being a regular reader of your "Serviceman" articles, I am surprised to find a great deal of this column seems to consist of problems related to Sanyo TVs.

Working for a company which inherited the servicing of some Sanyo TVs, I took it upon myself to get some of the most common problems ironed out before confronting my first customers. With this in mind, I visited a friend who is a local serviceman with years of experience with all brands of TVs. His one piece of advice which stood me in excellent stead to confront most of the faults a Sanyo seems to produce was "look out for pinkies".

A very large percentage of the problems in a Sanyo seem to be caused by electrolytics drying out. These capacitors started life coloured grey. Whether it is due to heat or leaking electrolyte, the plastic skin of a faulty capacitor turns pink or in extreme conditions, when short circuit, a chocolate brown.

By checking all electros for discolouration and replacing those which show the sign of wear and tear, the common problems which seem to fill the pages of "Serviceman" can be eliminated with the greatest of ease.

A. MacGregor,
Sunbury, Vic.

The "Serviceman" comments: If only it was as easy as that. Some faulty electros do change colour but most are far more sneaky.

Back issues wanted

I am a reader of your great magazine and I also like the way you deal with everything in electronics. I am interested in television and I like reading the Serviceman over and over. I would like to get back issues of "Radio, Television and Hobbies" and "Electronics Australia" and books about television as advertised in your magazine many years ago or let me know where to get them. I am only 15 years old.

Peter Phillips,
17 Cuthbert St,
Aspley, Qld.

COMMENT: As you can see we have published your name and address. There's always the possibility that a Brisbane reader has a collection of back issues that he is prepared to let you have.

Books & Literature

A complete video handbook

THE COMPLETE HANDBOOK OF VIDEO, by David Owen and Mark Denton. Published by Penguin Books, Harmondsworth, Middlesex, England. Soft covers, 224 pages, 255mm × 175mm. Lavishly illustrated with diagrams and photographs, both monochrome and colour. ISBM 0 14 046. 545 6. Recommended Australian price, $12.95.

This is a quite lavishly produced book, with imaginative layouts, good quality paper and printing, and freely illustrated in mono and colour.

The index is also quite impressive. Chapter headings include: The Video User's Guide; The Video Buyer's Guide; The TV Connection; All About Cameras; The Video Director; Making Video Work For You; Optional Extras; Appendices.

Unfortunately, that's the good news. The bad news is that the technical text does not stand up well to detailed examination, with far too many inaccuracies in evidence. Some of these are merely mildly irritating, like "Hertz per second", and NTSC as the acronym for a misquoted "Never the Same Colour Twice". Others are more serious.

On page 69 there is a description of how to use a crimping tool to fit a connector to a cable. Apart from the fact that the instructions are barely adequate anyway, they include the following quaint phrase, ". . . insert the central conductor which acts to increase the energy supply across the connection". What does it mean? You work it out.

On the same page is another panel describing how to splice tape. Again, the instructions are very condensed but, in any case, they would appear to have been formulated for audio tape, and make no allowance for the very real problems involved in splicing video tape — even assuming it to be an acceptable practice!

On page 109 (Caring For Your Camera) there is portrayed a multimeter with instructions on how to test a cable for continuity. One label on the drawing, arrowed to the appropriate scale reads, "Ohm scale (to measure intensity of current)". A second label reads, "DC scale (to measure battery current)". It is pointing to the decibel scale.

But the (booby) prize must surely go to the drawing at the top of page 25, which purports to show a typical VCR tape path and recording mechanism. It portrays the drum as carrying three heads dispersed around its top edge; playback, erase and record, in the latter instance drawn in one place with the arrow running somewhere else. Not only is the disposition of heads thoroughly untypical of a domestic deck, but the heads would never even contact the tape!

It is hard to say how many other questionable statements might emerge from a detailed reading of the technical matter.

In the latter part of the book, dealing with ways to use video cameras — story telling, direction, lighting, continuity, etc — the authors appear to be on more familiar ground. While the value of the material may be debatable in one or two instances, there do not appear to be any major errors.

There is even a chapter on Home Erotica (making one's own adult movies) which, if nothing else, is good for a few giggles.

"To prevent unsightly close-ups of gooseflesh, heat the room first."

But the overall reaction is one of disappointment. Given a more carefully edited text, a book as visually attractive and otherwise as well produced as this could have been a winner.

As it is — just so-so. (P.G.W.)

Logic circuits

UNDERSTANDING DIGITAL LOGIC CIRCUITS by Robert G. Middleton. Published by Howard Sams & Co, Ind 1982. Soft covers, 135 x 215mm, 392 pages, illustrated with photographs and diagrams. ISBN 0-672-21867-4. Price $27.95.

This book is intended for technicians who are now involved in servicing analog equipment and who wish to expand their expertise in digital electronics. The emphasis is on the type of digital logic circuits encountered in appliances such as scanner scanning receivers, video cassette recorders and digital test instruments.

The book begins with a discussion of logic diagrams and basic gates. Nineteen chapters are included, covering input and output waveforms, De Morgan's laws, basic adders, flipflops and clock circuits, counters, interfacing considerations, video games and memories among other topics.

Practice as well as theory is comprehensively examined, with trouble-shooting tips provided for many of the digital control circuits in common use. The text is well supported with diagrams of gate operation and pin-outs of typical TTL packages and should form a valuable reference for anyone who wishes to expand their knowledge of logic circuitry.

One puzzling fact in a book of this nature is that microprocessors are not mentioned at all, in spite of the occurence of chapters on RS232 interfacing and the use of MOS memory devices. As a guide to trouble-shooting servicing typical consumer equipment, however, the book can be commended.

Our review copy came from McGill's Authorised Newsagency, 187 Elizabeth St, Melbourne, 3000.

Playing the sharemarket

PLAYING THE STOCK AND BOND MARKETS WITH YOUR PERSONAL COMPUTER by L. R. Schmeltz. Soft covers, 308 pages, 128 x 210mm, illustrated with photos and sample programs. Published by TAB Books Inc 1981. Price $15.95. ISBN 0-8306-1251-3.

Although published in the United States and dealing exclusively with the American scene, this book includes some worthwhile advice for small investors interested in using a computer to keep track of share market transactions.

Chapters include an introduction and author's disclaimer, a brief guide to current personal computers and separate

headings on setting goals, selecting shares, approaches to the market, the uses of computers, sample programs for investment strategies and record keeping and "The Nuts and Bolts of Computer Operation".

The sample programs provided include elementary trend analysis routines based on several investment "systems". The program listings provided are in Applesoft Basic, but full details are given for conversion to other versions of the language.

Apart from its general advice and the program listings one of the most valuable sections of the book are two extensive glossaries, one of computing terms and the other of share-market jargon. Three appendices provide a list of commercially available programs, sources of further information (relevant in the US only) and an extensive reading list.

Perhaps the best way to sum up the theme of this book is to quote the author's own words "an average investor can make his own decisions and do just fine".

Our review copy came from McGills Authorised Newsagency, 187 Elizabeth St, Melbourne, 3000.

Computers in amateur radio

MICROCOMPUTERS IN AMATEUR RADIO by Joe Kasser. Published by TAB Books Inc 1981. Soft covers, 128 x 210mm, 306 pages, illustrated with diagrams. ISBN 0-8306-1305-6. Price $15.95.

The subtitle of this book is "Putting microprocessor-based computers to work as viable station accessories". According to the author a microcomputer can significantly improve the operation of an amateur radio station, in, for example, the tuning of receivers and transmitters, initiation of pre-scheduled transmissions and record-keeping.

Morse code and radioteletype applications are covered and circuits provided for computer interfaces for signal decoding. Programming is covered on a general basis, including common program errors.

A large proportion of the book describes the "GOLEM-80" project, an S-100 microcomputer put together by the Chesapeake Microcomputer Club and the Radio Amateur Satellite Corporation (AMSAT). The discussion is in general terms only, with no circuit diagrams or details of operation.

Appendices making up about 25% of the book provide listings in 8080 assembly language for the AMS-80 Monitor program used by GOLEM, a video driver for a 64 x 16 memory mapped display (the board itself is not described), a calculator for orbits of the OSCAR amateur radio satellites, morse code generator, RTTY program and a real-time clock.

Since much of the material concerns facilities which are in use only in the United States and circuits for a particular club project, the chief value of this book must be considered "inspirational". The extensive software listings could be useful to anyone wishing to write similar programs, but without details of the hardware with which they are used it is not possible to implement them directly.

Our review copy came from the ANZ Book Company Pty Ltd, PO Box 459, Brookvale, NSW 2100.

IERE conference

ELECTROMAGNETIC INCOMPATIBILITY: IERE Conference Proceedings No. 56. Soft covers, 322 pages, 210 x 292mm, illustrated. ISBN 0 903748 51 7 Price £35.

This book contains the proceedings of the International Conference on Electromagnetic Incompatibility held at the University of Surrey, UK on September 21-23, 1982. Thirty papers are reproduced in full, on subjects such as lightning damage to aircraft electronics, measurement of microwave radiation emissions, the interference effects of CB radio and the screening performance of RF coaxial cables and connectors.

Modelling and analysis and the use of topological techniques at the design stages to minimise conducted and radiated electromagnetic interference are covered in several papers, while another looks at a proposed syllabus for a university level course in RF interference and prevention procedures.

The book will be a useful reference for those working in communications, equipment design and other fields where interference problems must be dealt with. Contact the Publications and Sales Controller, Institution of Electronic and Radio Engineers, 99 Gower Street, London, UK WC1E 6AZ.

DXer's Diary

The 1983 "International DXers Diary", published by The Finnish DX Association is now available. The compact 88 x 148mm diary has a section for each day of 1983 and provides reminders of all the major national anniversaries of the world, and days specially marked by various shortwave broadcasters.

In addition there is an article by Arthur Cushen on shortwave listening and technical articles in Finnish, as well as a list of some major shortwave stations.

The diary is available from Arthur Cushen at $A7.00. For further information write to Arthur at 212 Earn St, Invercargill, New Zealand.

New Products...

Product reviews, releases & services

Hanimex "Diaprint" turns slides into prints

A new photographic printer developed by Hanimex allows slide enthusiasts to make instant prints from slides. The device can be used as a "stand alone" printer, or can be mounted on any current Hanimex La Ronde slide projector to produce prints even while a slide show is in progress.

Designed by Hanimex's own team of engineers, "Diaprint" was unveiled recently during the Photokina photographic exhibition, held in Cologne, West Germany, where it attracted considerable attention.

When a particular slide is favoured and a print desired, the Diaprint device is capable of duplicating the image in either colour or black and white, magnifying the slide 3.5 times.

Hanimex's Diaprint uses Polaroid peel apart film and produces properly exposed prints through use of an electronically controlled exposure system. Black and white prints are said to take only 30 seconds, while colour prints are produced in about one minute. To achieve maximum definition Hanimex has mounted a 38mm f/5.6 colour corrected lens which can be stopped down to f/16, and a brighten/darken control facility is provided.

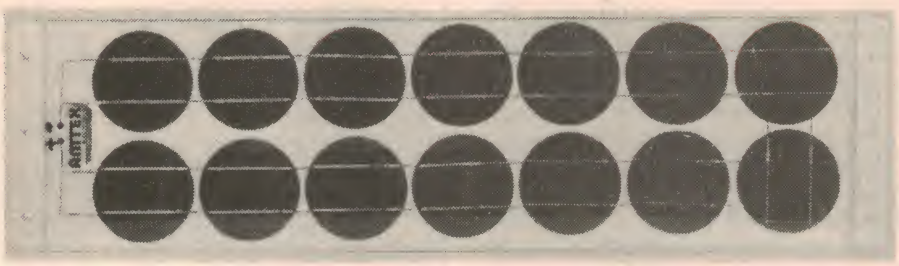
The Hanimex Diaprint prints a copy of a colour slide in about one minute.

Because the unit is battery operated it is fully portable, and a single set of four "AA" size alkaline batteries are said to provide power for up to 500 prints. An "Auto-Off" features ensures that batteries are conserved.

Cost of the Diaprint is around $200, and for those wishing to mount the printer directly onto a slide projector Hanimex provides three models to suit, ranging in price from around $169 to $275.

More information is available from Hanimex Pty Ltd, 108 Old Pittwater Road, Brookvale, NSW, 2100. Telephone: (02) 938 0400.

Amtex ready-built solar power panels



Many people have responded to the Solar Powered Fountain project presented in the November, 1982 issue of "Electronics Australia", but have indicated that they do not wish to assemble the solar panel themselves.

Until recently there was no choice in the matter but now Amtex Electronics have come to the rescue with a kit which includes a pre-assembled solar panel. Unlike the do-it-yourself version the panel uses a finned, anodised aluminium extrusion as its base, and the solar cells are encapsulated in RTV silicon rubber with a Lexan front top surface.

Price of the assembled solar panel and pump is $195 plus $5 postage and handling, while the pump itself is available separately at $20, with the same charge for postage and handling. The pump is fully submersible and is now rated at 1500 litres per hour, running on 12V DC at 3.5A. Applications include topping up caravan header tanks, gardening and aerating fishponds, to name a few.

For more information contact Amtex Electronics, PO Box 285, Chatswood, NSW 2067. The phone number is (02) 411 1323.

Mining equipment exhibition for Sydney

Nineteen British companies will show their latest machinery and equipment at the International Mining and Exploration Exhibition (AIMEX) being held at the RAS Showground in Sydney from February 7 to 12, 1983.

The exhibition has been arranged by the Association of British Mining Equipment Companies (ABMEC) in co-operation with the British Overseas Trade Board. The exhibition will occupy some 1280 square metres of stand space in the Manufacturers Hall.

Among the products on display will be communications and signalling equipment, conveyors, couplings and connectors, dump trucks, filtration equipment, power packs, roof supports, safety aids, special lubricants, and tunnelling, drilling and loading machines.

National Semiconductor microprocessor modules

National Semiconductor Corporation now has available a 62-page data booklet containing data sheets on the first 14 of its Series/800 CMOS Industrial Microcomputer boards.

Series/800 is a complete range of microcomputer products aimed at applications in harsh industrial environments. The line includes CPU, memory boards and digital and analog I/0 components.

Also available from National Semiconductor are four new members of its high speed CMOS microcomputer modules, the MA2000 series.

For more information contact National Semiconductor Corporation, Cnr Stud Road and Mountain Highway, Bayswater, Vic. 3153.

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Quotation from Electronics Australia, June 1982.

Try it yourself . . . and see why Electronics Australia liked it so much! The new 'Blue Label' System 80 computer has even more features than before – and best news of all, it actually costs less!

"Overall we are very impressed with the Blue Label System 80. On a dollar per function basis it probably represents the best value around for a ready-built computer. Other systems can be bought for less, but ultimately they are not as readily expandable as the System 80. There is also the matter of software, and here the System 80 really scores, with hundreds of compatible programs available for the TRS-80 as well as those specially written for the System 80".

Reprinted with kind permission from ELECTRONICS AUSTRALIA, June 1982.

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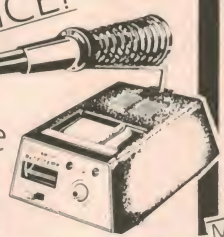

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New Products

Bosch digital clock has control outputs

Robert Bosch (Australia) Pty Ltd is now manufacturing a fully programmable digital computer clock. Apart from providing an attractive timepiece which shows time and day of the week, the "Digitimer DT 201" is equipped with a programmable controller which can switch four power outlets independently to control most applicances.

The computer can be programmed with a calculator-type keyboard to perform up to 20 daily or weekly switching functions. Appliances to a total of 10A can be switched on and off at exactly pre-determined times. Applications include security lighting, shop displays, aquarium control, air conditioning and heater control and irrigation, apart from household uses.

A 9V battery can be installed to maintain time and memory functions in the event of a mains power failure.

For details contact Robert Bosch (Australia) Pty Ltd, PO Box 66, Clayton, Vic 3168.

New Products from Bill Edge

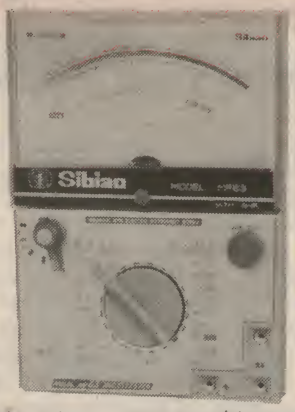
Bill Edge's Electronic Agencies now has available the "Screamer", an ear-splitting siren alarm said to put out a sound pressure level of 120dB at one metre. The sound produced is a warble, alternating between 1.2kHz and 1.5kHz, and the unit operates from a 6-12V supply.

The "Screamer" is a compact 85 x 102mm (L x D) and is supplied in a robust moulded plastic housing with a separate metal mounting bracket. Retail price is $34.50.

Also available from Electronic Agencies is the Sibiao MF63 Multitester, an analog multimeter with 38 measuring ranges and four extended function scales, able to measure AC and DC current and voltage, resistance, capacitance, audio output level in dB and the h_{fe} parameter of transistors.

The Multitester uses both a function switch and a range selector switch to allow selection of the full measuring ranges in a reasonably compact space.

Dimensions of the unit are 171 x 122 x 59mm and weight is approximately 500g without the six 1.5V AA cell power supply. Probes, batteries and a spare fuse are included in the price, along with an accessory transistor test socket.



The Sibiao MF63 "Multitester"

Further information is available from Bill Edge's Electronic Agencies, 115-117 Parramatta Rd, Concord, NSW 2137 or 117 York St, Sydney. Phone (02) 29 2098.

Applications of SCRs in high power inverters

Quentron Optics Pty Ltd has announced the availability of a 12-page leaflet describing the use of high power SCR resonant high frequency power inverters.

The use of SCRs in power inverters has previously been restricted to applications at frequencies below 10kHz because of the long turn on and turn off times of SCRs. New developments in the high frequency performance of SCRs are changing this situation, and the leaflet, from Spellman High Voltage Electronics Corporation, shows how the newer devices can be used in inverters at operating frequencies up to 100kHz.

Examples covered in the paper include a design for a power supply rated at 300 amps at 5V and an induction heater operating at 100kHz. Spellman manufacture high voltage supplies using high efficiency inverters based on SCRs.

A copy of the paper and details of high voltage products are available on request from Quentron Pty Ltd, PO Box 75, Redfern, NSW, 2016. Phone (02) 698 9277.

New Products

GE introduces "trunked' mobile radio

General Electric Mobile Radio Ltd, of Ryde, NSW, are in the process of introducing a trunk mobile radio communication system for subscribers in the Sydney area. This follows the successful introduction of a similar system in Melbourne. Known as the General Electric Mark V mobile radio system, it is aimed at overcoming the crowding which often occurs on shared single channels while, at the same time, making the best use of available channels.

The system will use five channels in the 800MHz (UHF) band, which have been allocated to the company by the Department of Communications. To ensure that these channels are used effectively the Department requires that there be a minimum of 70 users (ie mobiles) in the system, but would prefer it to be nearer 100.

In fact, statistics suggest that the five channel system could cater for up to 700 users. Even at this loading, a user should have a 60% chance of getting a free channel at the first attempt.

Selection of a channel is completely automatic. When a user initiates a call the system automatically searches for a vacant channel and, when it finds one, locks onto it. The system then transmits a code which identifies the particular mobile, the receiver of which is continuously scanning all five channels. As soon as it recognises its own code it latches onto that channel and sounds an alert tone to attract the user's attention. If the vehicle is unattended, a light will be activated to advise the driver on his return.

Calls initiated from a vehicle are handled in much the same way; the vehicle equipment looks for a vacant channel, locks onto it, and activates the base.

Once a channel is selected it is made exclusive for the duration of that call; no other subscriber can interfere with it, or eavesdrop on it. And, fairly obviously, up to five subscribers can use the system at any one time.

Systems such as this should go a long way in making far more efficient use of radio channels than has been possible in the past; offering less congestion on the one hand, yet making it possible for more companies to enjoy the benefits of communication with their vehicles.

The Mark V trunked radio system is available in a number of variously styled units, with installation and antenna mounting included in the price. There is no charge for calls on the trunk network.

For further information contact General Electric Mobile Radio Ltd, 5 Byfield St, North Ryde. Telephone (02) 888 8111.

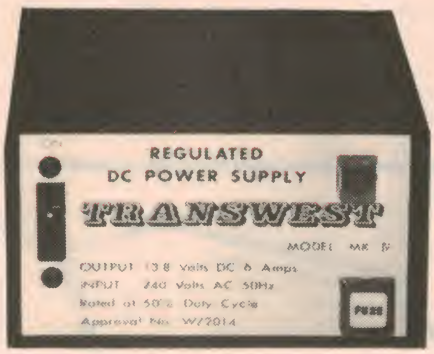
Audio, radio catalog from Benelec Pty Ltd

IFTA Australia has changed its name to Benelec Pty Ltd and has produced a new catalog covering its range of acoustic and radio engineering products. Power supplies, antenna systems and loudspeakers are specialities of the company.

Benelec distribute a range of 13.8V power supplies suited for powering equipment designed to operate from a nominal 12V DC battery supply.

The SEC-approved "Panther" power supply is rated to supply 2A continuously and 4A peak. Features include an LED power-on indicator and short circuit protection.

The "Transwest Model Mk III" is rated to deliver 4A at 50% duty cycle and up to 7.5A peak. The power supply is housed in a metal case with rear mounted output terminals. The power switch and mains fuse are mounted on the front panel. The "Transwest Model MkIV" has the same features as the MKIII model but is rated to deliver 6A, with 10A available at peak.



Transwest Model MkIV 13.8V regulated power supply from Benelec Pty Ltd.

Three new unity gain and two 3dB colinear antennas for operation on the 70-85MHz VHF low band are also offered by Benelec Pty Ltd. The three unity gain antennas include a side mounted folded dipole, a ground plane and a coaxial dipole type. All are designed for vertically polarised operation.

For more information on any of the products mentioned here contact Benelec Pty Ltd, PO Box 21, Bondi Beach, NSW, 2026, or telephone (02) 665 8211.

MicroBee . . . from p97

preliminary word processor manual provides sufficient information to connect a printer without a great deal of trial and error.

Although extensive, WordBee does have some faults. The lack of easily remembered control command names is one. More serious is the apparent absence of any command which allows spaces to be opened in text to insert new material. It can be done with the use of the Block copy mode, or the Find and replace function, but this seems like a lot of work just to insert a missing letter, for example.

Other failings are no doubt due to the fact that we reviewed a preliminary version of the program. The most glaring is the "Kil" or erase function, which according to the manual double checks the user's intention before deleting a text file. In our version of the program, it does not.

These details aside, WordBee is an impressive program, and is considerably enhanced by the features of the MicroBee itself. Bearing in mind the reservations expressed on the robustness of the keyboard, the MicroBee with WordBee would not be out of place in the small business.

Conclusions

All in all the MicroBee is a compact, powerful computer, with features equally likely to meet the needs of the newcomer and the experienced computer user. For the newcomer the manuals leave something to be desired, despite the presence of a tutorial section (why is it one of the last sections in the book?).

Experienced programmers will be delighted by the power and flexibility of MicroWorld Basic and the extensive graphics capabilities of the MicroBee. A simple program to clear the entire memory will circumvent problems caused by retention of programs in memory. Ultimately, though, a heftier power supply may be required if much expansion of the system is planned.

With these reservations, the MicroBee seems to provide excellent value for the price. If Applied Technology's marketing and manufacturing plans are realised, the system will take off in a big way!

A MicroBee with 16K of memory and MicroWorld Basic costs $449. An additional 16K of memory adds $100 to the price. The WordBee word processing program is $89.50 and an Editor/Assembler in ROM is available for $59.50. An S-100 expansion interface is also available, at $299, with disk drive, controller and CP/M operating system for $799. There is no shortage of expansion options.

COMPUTER SENSATION!!

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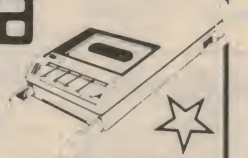

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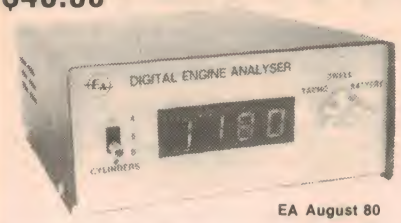

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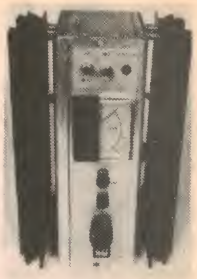

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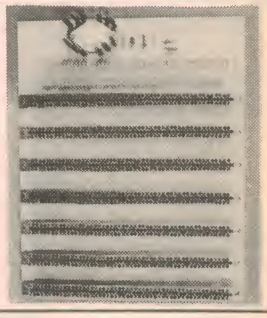

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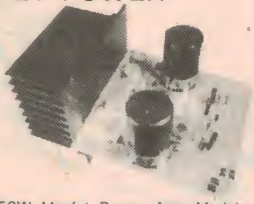

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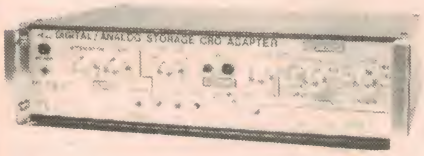

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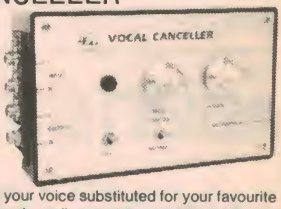

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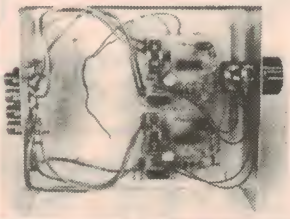

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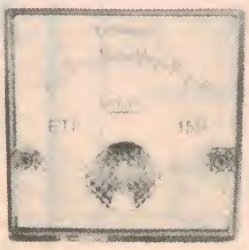

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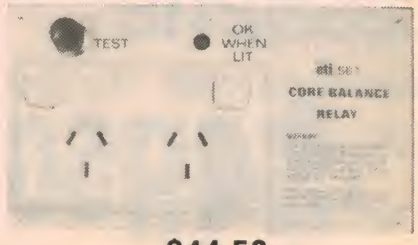

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Shortwave Scene

by Arthur Cushen, MBE

BBC announces major expansion plans

Following close on the 50th anniversary of the BBC External Service comes the news of the expansion of transmitting facilities and plans to link relay bases by satellite.

The BBC transmitting sites in the United Kingdom are located at Daventry (in operation since 1932), Rampisham, Woofferton and Skelton. The Woofferton site is mainly used by the Voice of America and schedules most VOA programs from the United Kingdom. Skelton and Rampisham carry mainly World and External Service programs, while Daventry, the largest site, programs many of the foreign language broadcasts heard from London.

Daventry now covers 250 acres with an extensive array of antennas, and 14 transmitters; four 250kW, eight of 100kW and two of 30kW, used for single sideband transmission of programs to overseas relay bases.

The Rampisham transmitting site is located in south-west England not far from the sea and covers 190 acres. In the transmitting building there are four 250kW transmitters and two 100kW transmitters, covering 35 shortwave frequencies. Rampisham is in the middle of massive modernisation and over the next five years its four 250kW transmitters will be replaced by eight 500kW transmitters, new antennas installed and the whole staion brought under computer control.

The first satellite link between Bush House in London and an overseas relay base has been in operation for some months with the transmitters in Cyprus being linked to the London studios. This satellite link has now been extended to Singapore and the BBC plans to link the Ascension and Antigua sites when facilities become available.

31 METRE BAND EXPANSION

As well as stations moving into the section 9775-10000kHz, there has been an increasing use of the band between 9400-9500kHz in recent months. The BBC has been operating for more than 30 years on 9410kHz but now this part of the band is becoming congested as countries realise that there are several vacant channels. On 9420kHz. Athens, Greece is noted at 1900 with a broadcast to Europe which includes English 1920, French 1930 and German at 1940UTC. The frequency is also used at 2000UTC in European languages, while at 2100 and 2200 there are transmissions in Greek to Australia. Radio Tirana, Albania has been using 9430kHz at 2000 for a broadcast in Portuguese and the nearby channel of 9440kHz is used by Israel at 2000 for a broadcast in English. Cairo uses 9475kHz with English 0200-0330, while Trans World Radio at Monte Carlo uses 9495kHz from 0725UTC with gospel broadcasts in English. Many other frequencies in this section are used by Radio Moscow in its various language services.

NEW SERVICES

Radio France International recently commenced a service to Latin America now heard on a regular basis from 2300-0100UTC. The languages broadcast are Spanish 2300, Portuguese 2330, French 0000, and Spanish at 0030UTC. The frequencies used are 9785 which replaces 9790kHz; 11965, 11995 which are audible in this area and 6085 and 6140kHz.

Radio Nacional, Brazilia has introduced a new language schedule and now broadcasts at 1800-1900UTC in English on 15435kHz, 1900-2000UTC in German on 15435 and 2100-200 in German on 17720kHz. Broadcasts to North America in English at 0200 are on 15290 and 17830kHz; and to South America at 0000UTC in Spanish on 9665kHz.

Radio Afghanistan has retimed its English service to 1000-1030UTC and is received on 21460, with 6230 and 17720 also carrying the transmission. The station suffers jamming splatter from 21455kHz and according to John Mainland reporting in the NZ DX Times, they have also announced the use of 15255kHz.

Radio Nacional in Caracas, Venezuela, has extended its schedule and is using 9530kHz for a broadcast to Latin America and the Caribbean areas. The BBC Monitoring Service reports that the schedule is announced as 0100-0200, 0300-0400, 1100-1200 and 1800-1900UTC.

NEW FREQUENCIES

BULGARIA: Radio Sofia has been heard on 11720kHz with English 0400-0500UTC. This is a new frequency which carries the broadcast to North America.

CZECHOSLOVAKIA: Radio Prague is using 11950kHz for English at 0300-0350UTC, in addition to 9610kHz. The broadcast to Australia in English at 0730-0800UTC is on 11855, 17840 and 21705kHz.

GREECE: Athens has been heard on 7095kHz 0500-0600 in Greek and the transmission continued in Turkish to 0615UTC. Another new frequency is 9420kHz noted at 2000UTC.

ISRAEL: Jerusalem has been heard on new frequency of 9440kHz at 2000UTC with an English transmission. The broadcast is also carried on 9009, 9815, 11640, 15585 and 17685kHz.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing daylight time, add a further hour.

REVIEWS OF RECENT

Records & Tapes

CLASSICAL ● POPULAR ● SPECIAL INTEREST

ELLY AMELING SINGS DEBUSSY & FAURE: Delightful . . ."

DEBUSSY, FAURE. Nine songs by each of these composers sung by Elly Ameling (soprano). Dalton Baldwin, accompanist. CBS Analogue Stereo disc CX 74027.

On the back of the sleeve of this delightful recital are some very perceptive notes by Ned Roram on the difference between German lieder and French melodies, their form and style of performance. The record consists of songs by Faure and Debussy and readers may be interested to learn from Mr Roram, what one thought of the other. Debussy was 17 years younger than Faure yet was outlived by the latter. During their creative periods, it was the younger man who wrote the most memorable music.

About this time, the creation of the lieder was slowly fading. There remained, of course, Richard Strauss, Hugo Wolf and some minor figures but few musicians will deny that the dominating songwriters of the 19th century were Faure and Debussy.

At this point the one's opinion of the other might interest readers. The older man complained; "Never speak to me of Debussy. I don't want to know there is a Debussy. If I like Debussy, I can no longer like Faure. How can I then be Faure?"

Debussy's only recorded remark about Faure was: "We heard a Ballade by the Master of Charms almost as lovely as pianist Hasselmans herself, who kept having to straighten her shoulder straps as they fell down at every scale. I somehow relate these gestures with the Music of Faure himself. The play of fleeting curves that is the essence of his music can be compared to the movements of a beautiful woman, without either suffering from the contrast."

The two most important lieder writers were Schubert and Schumann. Strauss and Wolf came later. Faure and Debussy led in melodic composition. There is

evidence to suggest that, music apart, the dislike between Debussy and Faure sprang from jealousy over a woman. I think it was more due to Faure's recognition of the sensuous beauty and wit of Debussy as superior to his own, however great his own talent may be.

Germany and France were the only two European countries to excell in songwriting – if, of course, one omits Moussorgsky. For 30 years Schubert and Schumann monopolised the field. They were followed later by Brahms. Importantly the French chose their own countrymen as librettists, often Verlaine, while the Germans chose anyone that came their way, however banal. This is not to deny the beauty of the settings of some of the more crass words.

Being mostly strophic, the German lieder were more easily remembered – and delivered – mostly by a technique of contrast than the more elusive French rivals, who proved much more difficult go to listen to. And importantly, it was Faure that freed the accompanist from being a mere support or descriptive shadow of the words.

Different language setting produced entirely different styles, the stanza-like settings of so many lieder being no match for the slippery elusiveness of a poet like Verlaine.

My reason for using such a long introduction to the disc in question is that it is so full of delights – nine songs of Debussy and the same number of Faure, all performed so delightfully that it leaves me nothing but the highest praise to use in reviewing it. Elly Amerling's clear, sensitive soprano, never forced on the highest notes, and always capable of retaining its alluring quality in the lowest, is used with complete understanding of the material concerned.

So what can I write except to encourage all with French tastes to acquire it as soon as possible?

The analog sound is first class, always clear and expressive. Baldwin is a competent accompanist (J.R.)

BEETHOVEN/ASHKENAZY — "Intriguing . . ."

BEETHOVEN – Symphony No. 5 in C Minor. Leonora Overture No. 3. Philharmonic Orchestra conducted by Vladimir Ashkenazy. Decca chromium dioxide Cassette. KSXDC7540.

After the justified acclamation received by Carlos Kleber's magnificent performance not so long ago, it must have needed great courage to issue another by different artists so soon after. But Ashkenazy's reading is so different that I can follow Decca's reasoning.

Ashkenazy's is an exciting if sometimes odd interpretation. There are moments when it can only be described as over-expressed, with little pauses, unexpected accents, agogic and otherwise. Much of it is unlike his piano style, yet there is a faint air of a pianist's reading about the whole work. However, somehow or other, most of it comes off splendidly.

Countless orthodox performances of the Fifth are obtainable. Some are better than others. Kleber's overwhelmed: Ashkenay's intrigues. The only way I can convey all I want to say is to tell you to go and hear it for yourself. It is on a chromium dioxide cassette; the sound is excellent, the orchestral balance faultless and, different though it might be, it is still a fine issue.

Reviews in this section are by Julian Russell (J.R.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

It would be unfair not to add that Ashkenazy's little deviations have no hint of ever being just show-offs.

The Leonora No. 3 makes an excellent fill. (J.R.)

ELGAR – Violin Concerto in B Minor. Itzhak Perlman (violin) with the Chicago Symphony Orchestra conducted by Daniel Barenboim. DGG Digital disc 2532035.

How pleasant it is to hear such sweetness again, sweetness posed unsentimentally upon a solid base of form. There have been many fine recordings of this concerto down the years, starting with the renowned performance by the composer and the then boy genius Yehudi Menuhin. It reflected complete understanding between the man and the boy, neither of them freaks. Menuhin was a typical prodigy who later went through a period of musical uncertainty. Elgar, despite his association with the church, was not above dropping in at the corner pub on a Saturday to place a bet with his illegal SP operator.

Since then, every violinist of note – and a few of the others beside – have paid it their homage and it even achieved the distinction of becoming popular in Germany. (Richard Strauss was a great admirer of Elgar.)

Violinists of all nationalities have recorded it but have not seemed to enjoy the honeyed sweetness of their own playing so much as this young Israeli player. Here is happiness and enjoyment not often heard in this generation; emotion filled but never slick.

Perlman never advertises his virtuosity: it is part of him. His technique is in the early Heifetz class, although the temperature is much higher.

A digital recording, it is rich in detail although I would have been a trifle happier had the engineer not placed the soloist quite so far forward. A few of Elgar's delightful orchestral touches are obscured because of this.

One might describe the first movement as the performance one has always wanted to hear but never had the luck to do so. Barenboim and the Chicago provide impeccable support. Perlman always seems to be at his best when collaborating with his fellow-countryman.

Would it be safe to acclaim Perlman as the finest violinist playing today. I realise the vastness of the area the question covers but am tempted to say yes.

Now for a few ungrateful, churlish quibbles. Some of the phrasing is not always what you're used to and may surprise you. But I think this surprise will be accompanied by delight. Some of the tempos are a thought faster than usual, to my taste for the better. Another enthusiastic recommendation. (J.R.)

☆ ☆ ☆

JANACEK – Sinfonietta. Taras Bulba. Philips stereo cassette, played by the Rotterdam Philharmonic Orchestra conducted by David Zinman. 7300 874.

By now, most musicians have become used to Janacek's apparently crude, yet in reality highly sophisticated style. Chiefly responsible for this is the frequent performance of his unique operas and the Sinfonietta recorded here.

Janacek's musical path departs far from the general progress of Central European or French music. He deliberately avoids classical – or romantic – form, has a unique style of scoring, uses polytonality more freely than most "regular composers" and harmonises in a way one can only describe as unique.

We have many recordings of the Gewandhaus Orchestra of Amsterdam but few – at least in Australia – of the Rotterdam group. Here is a splendidly disciplined Rotterdam recording under the firm direction of David Zinman. This discipline is obvious in the very first allegro. Zinman avoids making the opening brass passages sound like a fanfare, as they so often do, but slurs them into a more conventional but still highly unusual shape. He gives us a lovely slow movement, his reading reflecting the true spirit of Janacek.

The work is in five movements – another eccentricity in Janacek's nomenclature – and each movement is subdivided into many parts, calling for swift changes in tempos and, especially, in rhythms. Zinman brings the whole five together admirably. The result is always logical, but does he capture the true "raw" spirit of Janacek? Of this I'm not quite sure.

Almost as well known as the Sinfonietta is Taras Bulba on the reverse side. Janacek called its three movements a rhapsodie. They may be rhapsodical in parts but are much more like a suite – a suite of death, for one occurs in all of the three pieces. They all have a program about which the composer was very reticent and much of the literary side must

BEETHOVEN Piano Concerto
"... a good recording"

BEETHOVEN: Piano Concerto No. 4 in G Major, Op. 58. Rudolf Serkin with Seiji Ozawa conducting the Boston Symphony Orchestra. Digital stereo, Telarc DG-10064. [From P. C. Stereo, PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612].

I found this a very enjoyable record and I feel that it would appeal, not only to those to whom the work is familiar but also to those normally prefer music of a lighter kind.

Let me hasten to add, however, that this fourth concerto is by no means "heavy" music. It is melodic, sometimes pensive, sometimes stirring, but always enjoyable.

An earlier Telarc recording by Serkin/Ozawa and the same orchestra – The Emperor Concerto – was a brilliant success but this one falls into a quite different category, if only because of the nature of the music.

The first movement, Allegro moderato, plays for 20 minutes, 15 seconds. It has about it a meditative quality, which certainly suited my mood when I put it on the turntable for the first time. I just wanted to go right on listening!

The slow movement, Adante con moto, is played very eloquently and, at times, subsides to such a low level that it demands completely quiet listening conditions. Fortunately, the Telarc pressing is equal to the demands it makes on the record's own noise level.

The final movement, Rondo: Vivace, emerges from its quietest moment and exploits the dynamic range of the pressing in the other direction – this time without any suggestion of harshness or overload.

And when the final, climatic chords die away, you'll probably say as I did: "that is a good recording" – the music, the performance, the distinct and uncluttered sound of sound of the piano, the unity and tone of the orchestra, and the quality of the record itself. And, for good measure, it comes in a handsomely produced double-fold jacket with generous notes.

My tip is that it will find wide acceptance, alongside the already popular "Emperor". (W.N.W.)

be guessed. But, as a rule, the title gives a plain enough clue to make an educated guess at the pictorial contents.

Janacek uses a huge brass section in his large orchestra — 12 trumpets, two bass trumpets, four trombones, two tenor tubas and a bass tuba. Of these, he sets apart from a more conventional orchestra nine trumpets, the bass trumpets and tenor tubas with timps added. These are used only at the beginning and, with the rest of the musicians at the end of the work.

The reason for this odd combination is easy for a musician to understand. Janacek had been commissioned to write some fanfares for a gymnastic display in Prague. After their use for this function Janacek was as reluctant as almost any other major composer to let such themes go to waste and used them again in Taras Bulba.

The first piece is quiet, in the form of a lament — "The Death of Andrif" — with some of it unmistakeably like the more lyrical bits of "Jenufa". There is also some obvious battle music and a lament on the death of a son at this father's hands.

The second movement, "The Death of Ostap", a vivid account of death and torture, is full of real, not simulated turmoil.

The third is titled (by Janacek?) "The Prophecy and Death of Taras Bulba" which graphically describes just that.

Zinman conducts the work sanely and, despite temptations, without overexpression. And the Rotterdam Orchestra clearly needs more exposure to the public.

The sound quality is excellent. (J.R.)

☆ ☆ ☆

THE VOICE OF IRELAND. Ruby Murray. World Record Club WC 3270.

Originally recorded in mono by Capitol, this record has been given the "Duophonic" treatment to enhance its playing on stereo equipment; but, like a lot of these "enhancements", it does little to provide much in the way of stereo image.

That comment aside, it is a delightful record, with a dozen favourite Irish songs sung by a lady with a delightful voice. The titles are: The Green Glens of Antrim — When Irish Eyes Are Smiling — It's A Great Day For The Irish — The Mountains Of Mourne — If You're Irish Come Into The Parlour — Galway Bay — Too-Ra Loo-Ra-Loo-Ral — Dear Old Donegal — How Can You Buy Killarney? — Phil The Fluter's Ball — Danny Boy — Teddy O'Neil.

The backing from Ray Martin's Orchestra helps make for an enjoyable musical experience. (N.J.M.)

The PACHELBEL CANON "You will be intrigued . . ."

THE PACHELBEL CANON. The Canadian Brass plays Great Baroque Music. Produced by Jay David Saks. Stereo, RCA ARL1-3554.

If you are a stranger to the Canadian Brass, or to these selections in particular, you will be startled by the very first notes of this recording. From that organ evergreen, Bach's "Toccata and Fugue in D minor", the opening chords emerge in the piercing sound of brass; and, just when you're wondering how they'll cope with the organ pedal notes, the tuba provides the answer in a most convincing manner.

My guess is that, from then on, your intrigue will grow as you listen through the rest of the program. You will be fascinated by the technique of the five players — all resident artists at the Banff Centre in Toronto (when they're not on tour in Canada, America or overseas). You will be amazed at the way phrases are transferred, with computer-like precision from player to player.

Aided by the timbre of the instruments — two trumpets, French horn, trombone and tuba — and by the mirror-clear stereo image, you will hear the structure of the works more distinctly than is ever likely to be the case from a conventional large organ in a conventional large environment.

Most of the tracks are transcriptions from the organ works of J. S. Bach: Toccata and Fugue in D Minor — Sheep May Safely Graze — "Gigue" Fugue — "Little Fugue" — Wachet Auf — Passacaglia and Fugue in C Minor. Other tracks, one of them the title track include: Canon (Pachelbel) — Toccata (Frescobaldi) — Suite from "Water Music" (Handel).

The detailed notes point out that transcriptions from the Baroque era do not transgress precedents set by the composers themselves and constitute a vital and challenging component of the Canadian Brass' extensive repertoire.

The notes also make on admission which answers the question: can that sound be produced by just five instrumentalists? for "Wachet Auf" at least, they resorted to overdubbing, to multiply their resources.

In approaching this recording, one might be tempted to compare it with a transcription made for synthesisers but such comparison is not valid. This is a performance by real musicians, playing real instruments in real time. Nor is it a case of choosing between it and an organ performance. You'll be the richer for having heard both!

Last but not least, the quality and tonal balance is first rate. (W.N.W.)

A CHORAL "1812"

TCHAIKOVSKY: 1812 Overture, choral version. Marche Slave. BEETHOVEN: Wellington's Victory. Vienna Philharmonic Orchestra; Chorus of the Vienna State Opera; directed by Lorin Maazel. Digital stereo, CBS D-37252.

To the best of my recollection, this is the first album I have ever seen, in which the jacket notes start off by excusing the contents: "It is well nigh impossible to find anyone who is willing to put in a good word for the three works recorded here."

As if to reinforce that sentiment, Julian Russell, who had received the recording for review, passed it over to me with a remark to the effect that the "1812 Overture", which dominates the cover design, is not held in high regard in classical music circles.

"You better do it for your audiophiles!"

In his jacket notes, Lorin Maazel suggests that the prejudice is due largely to "frequent performances by third-rate ensembles . . . in questionable acoustic surroundings". And if you take a stand against the 1812, then the other two are likely to be rejected along with it.

Yet, Maazel finds merit in the works, especially as played by "The magnificent Vienna Philharmonic".

Such argument aside, the 1812 Overture is no stranger to technically orientated audiophiles — a fact that has not been wasted on CBS. The album is prominently marked "Digital", "Audiophile Pressing", having been recorded on a Sony PCM 1600 recorder, edited with the help of a Sony DAE 1100, and produced on the CBS Discomputer system.

The 1812 Overture you will know, with its mix of orchestra — plus choir in this case — bells and cannon. Beethoven's Wellington's Victory contains a similar noisy — and somewhat tongue in cheek

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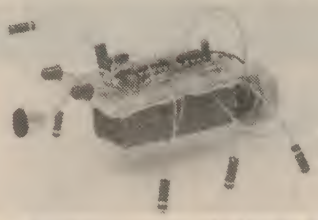

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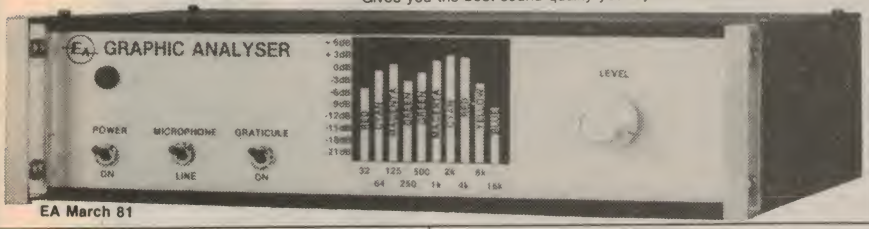

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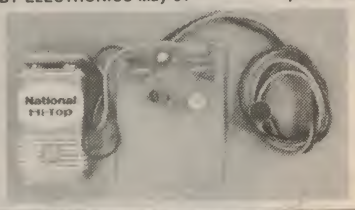

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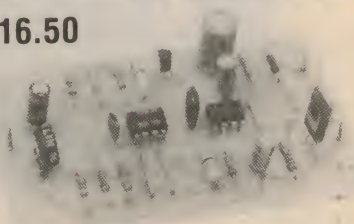

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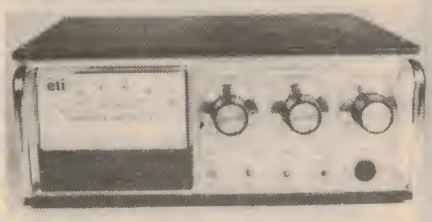

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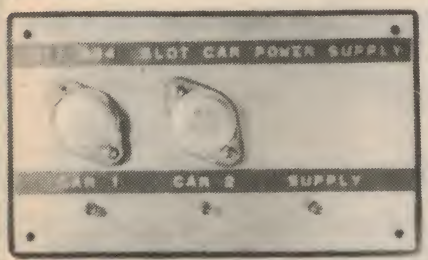

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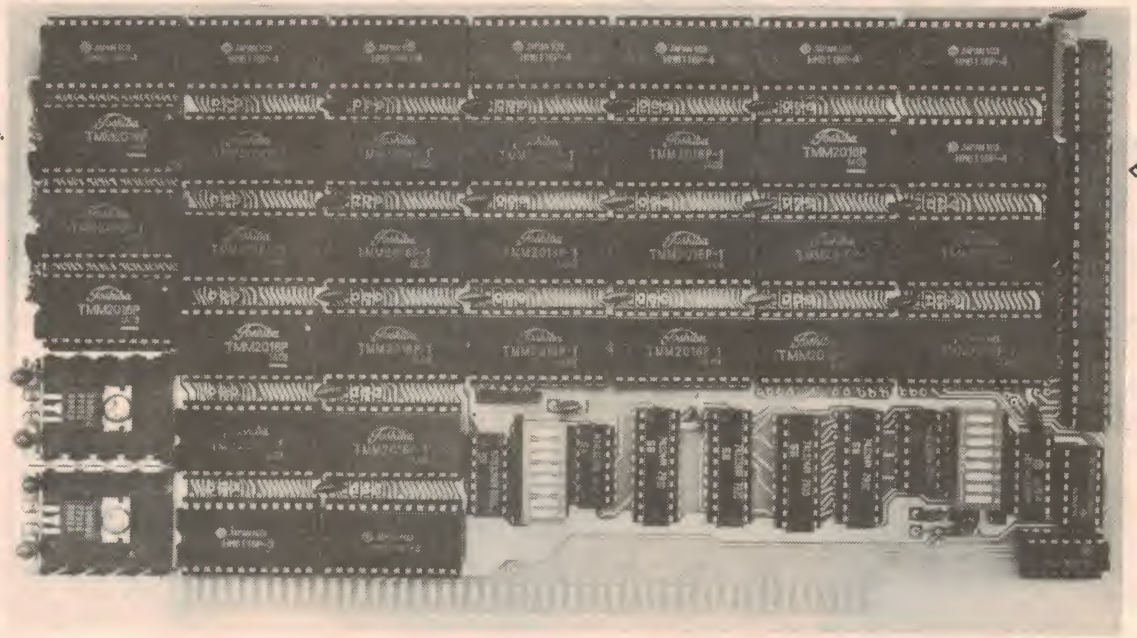

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— statement of patriotism and victory for the English, while Tchaikovsky does it again in Marche Slave for the Slavic heroes of the Turko-Serbian war.

This is not a performance for gentle souls who like a soothing or dignified musical music. What it will do is to make you wonder how a lone stylus in a groove can reconstruct such an enormously complex sound, and how loudspeakers can propagate it without flying apart half-way through!

It's an impressive disc — provided you're receptive to the contents. (W.N.W.)

☆ ☆ ☆

THE NUN'S STORY. Original motion picture score, composed and conducted by Franz Waxman. Stereo, Stanyan Records, POW-4024. Distributed by RCA.

This is another of the Stanyan series dated 1982 and featuring new performances of notable motion picture scores. Stanyan 4023 features "Gone With The Wind" (Max Steiner); 4025 features "Spellbound" (Miklos Rozsa); 4026 is "For Whom The Bell Tolls" (Victor Young).

Although Franz Waxman is named as the conductor of this performance, the orchestra itself is not identified. However, in other respects, the jacket notes are informative, with the credits of the film but, more particularly, focusing attention on Franz Waxman and his musical contribution to this and many other Hollywood features. Issue of the new album corrects the anomaly whereby Kathryn Hulme's novel and the film remained in popular demand but the original soundtrack album had long been out of print — virtually a collector's

item according to our information.

The music generally is in strong contrast with that of "Gone With The Wind". Whereas that score could be described as "of symphonic proportions", Waxman's themes for "The Nun's Story" are more varied, more introspective and more a direct reflection of Sister Luke's (Audrey Hepburn's) emotions:

Prelude and Credo — Leaving — The Holy Order — Farewell — Ave Maria Stella — I Accuse Myself — Haircutting & Gran Coro — Departure & The Congo — The New Room — Killing Of Aurelie — War Report — Last Meeting & Finale.

For those who enjoyed "The Nun's Story", the titles and the music of the 12 tracks should bring further pleasure. But, in any case, the score which won an Academy Award nomination is pleasant listening, while the album is a memento of one of the musical greats of the film world. The technical sound quality is entirely satisfactory. (W.N.W.)

MARIJOHN WILKIN, One Day At A Time. Word TWE 6005. The Word 20 Series. From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135. Phone (03) 729 3777.

This is another of the series from Word Records, featuring the 20 best from a number of the best known Gospel artists.

All the tracks are from Marijohn Wilkin's own pen, with a great number of her songs being written for such artists as Johnny Cash and Joan Baez.

Most of the tracks are sung in a quiet country and western style, some of the titles being: One Day At A Time — Behold The Man — God Is Love — Back In The Fold — Where I'm Going — Speak Louder — Let The Spirit Work In Silence — You Still The Troubled Waters — It's A Brand New World.

The quality is good, without any fancy dynamics, and the sleeve carries an interesting pocket biography of a versatile artist. (N.J.M.)

RECORDS SUPPLIERS: For information on World Record Club albums, contact the Club at 605 Camberwell Rd, Hartwell, Vic 3124. Tel. (03) 29 3636. They should not be confused with Word Records, who distribute mainly devotional albums, principally through religious booksellers.

We review a remarkable portable:

Computing on the go with the Otrona 512

The Otrona 512 is a portable computer that can be picked up and carried around like a briefcase but is a full-featured disk-based system, offering a wide array of features and software.

by PETER VERNON

The July, 1982 issue of the US magazine "Microcomputing" contains the story of David Kline, a free-lance journalist who used a portable computer to report on guerrilla operations in Afghanistan. With the help of the computer he was able to compose and file stories via the international telephone system, many hours ahead of his colleagues with more mundane equipment. His tale is a major boost for the portable computer.

The Otrona 512, imported in Australia by Elmeasco Instruments, is a "second generation" portable computer. With the concept already proved by the Osborne the designers added features such as high capacity disk drives and an 80-column screen while at the same time reducing the weight of the system.

Based on a Z80A 8-bit microprocessor running at 4MHz, the Otrona includes 64K of RAM. Disk and screen access is by way of a 9517 direct memory controller and is exceptionally fast, a feature which allows full use of the extensive graphics capabilities of the machine.

For transport, the Otrona 512 is a compact 30 x 14 x 38cm, (WxHxD) weighing about 8kg. In this mode the carrying handle doubles as a clamp holding the detachable keyboard in place over the dual disk drives and 14.5cm (diagonal) green phosphor CRT screen. The cabinet is moulded of white, impact resistant plastic.

When unfolded the handle acts as a support for the CRT and disk unit, and allows the keyboard to be unlatched from the front panel. A short removable cable connects the keyboard to the computer itself. We are told that this cable is a standard US telephone connector, available in several different lengths.

The keyboard is a full alphanumeric format, conforming to the IBM Selectric arrangement with additional cursor control and programmable multi-function keys. There is no separate numeric keypad, but Otrona do provide software to re-program the keyboard to create numeric keys in a standard calculator style layout. Unfortunately, no provision is made for re-labelling these keys, and this method must be considered a stop-gap at best.

Two built-in "slimline" minifloppy disk drives provide mass storage for the system. These are double-sided, double density units, each capable of storing 360K bytes when formatted for CP/M.

The video screen is capable of displaying upper and lower case characters (with descenders) in either 24 lines of 80 characters each or 24 lines of 40 double-sized characters. An extensive range of video attributes can be programmed, including high-lighted and half intensity characters, inverse video, overstrikes, underlines and sub- and superscripts.

A demonstration program supplied with the review machine illustrates these features, and includes a sample of the non-English alphabet and mathematical character sets. These capabilities, however, are seen to best advantage on a larger video monitor.

Graphics are also supported by the Otrona 512. Graphics resolution is 320 horizontally by 240 vertically, which is higher than many full-sized microcomputer systems.

At the rear of the computer are connections for peripheral equipment. Two RS232C serial ports are provided, with baud rates separately selectable from 75 to 19,200 bps. An RCA socket provides for connection of an auxiliary video display, without the necessity for any adapter.

Also at the rear is the mains input voltage selector (120-240VAC), fuseholder and power switch. A battery adapter and battery pack is optionally available, and plugs into a second panel connector. An expansion board can also be plugged into a slot on the rear panel.

Switching on . . .

Readying the Otrona for work is a fairly simple matter. The carrying handle is unlocked by two pushbutton latches (which seem a little balky and stiff to use). When unlatched the keyboard hinges downwards, connected by a thin cable which can be up to two metres long (apparently for the benefit of those using a larger video display).

If the system is switched on without a disk in Drive A the computer displays "no disk in place . . ." and enters a terminal emulation mode. A number of communications protocols can be implemented, allowing the Otrona to be used for data communications with mainframe computers. An acoustically-coupled modem is available separately.

As soon as we switched on we used the "set up" mode to check the terminal parameters. Pressing Control/Esc enters this mode, displaying several lines of status information at the bottom of the screen. The battery-powered clock and calendar were functioning, already set to the correct time and date.

Other keys, labelled on the keyboard, allow the user to vary the brightness of the display, the pitch and volume of the keyboard audio feedback, (four different click sounds plus "off") and the communications rates of both serial ports, (called printer and communications although they are full-featured ports not restricted to these uses) and to turn the keyboard bell on or off.

All these features are fully described in the opening chapters of the manuals which come with the system. Setting up instructions and details of changing the mains input voltage, power connector and fuse are also given. With the exception of the incomplete "programmers' reference guide", the manuals supplied with the Otrona are readable and easily understood.

Supplied with software

Software supplied with the Otrona 512 includes CP/M 2.2, BASIC-80, WordStar Plus, Valet 1.1 and Charton, plus a disk of utilities and demonstration programs. A powerful Monitor program, including diagnostic routines, is contained in ROM in the machine.

The language supplied with the Otrona 512 is MBASIC, the CP/M version of Microsoft's BASIC-80 V5.0 interpreter. This is a powerful, full-featured disk version of Basic conforming to the ANSI standard. Users with experience of other versions of Microsoft Basic will have no trouble adapting, and the extra features of the language greatly simplify the writing of large applications programs.

MBASIC strings can be up to 255 characters in length and variable names can be up to 40 characters long. In addition to integers and fixed point constants, MBASIC supports floating point numbers, in either single or double precision (16 significant digits). Hex and octal constants are also supported.

An attractive feature of the language is the use of variable type declarations, allowing the programmer to specify which variables will be stored in double precision, single precision etc. Single precision stores and calculates numeric values to eight significant digits and double precision allows 16 significant digits.

Control structures include the familiar IF . . . THEN . . . ELSE and also WHILE . . . WEND. Programs can be CHAINed together, with global variables declared by the statement COMMON. Variables can also be passed from one program to another, so that programs which are too large to fit into RAM can be run by calling in sections from disk as required.

Disk file handling capabilities are also included in the language, allowing both sequential and random access files to be created or read from Basic. Assembly language programs are also fully supported; the statement CALL allows assembly language routines to be executed from a given address, and allows variables to be passed to the routine. The USR statement is also available.

Comprehensive graphics statements are provided, to draw and erase points and lines, fill areas of the screen with patterned characters and to create new fill patterns, and to draw circles and arcs. Text can be laid over the graphics display or used in any combination with graphics, and the active plotting areas can be confined to any selected area of the screen.

Experienced programmers will appreciate the powerful editing functions and the extensive debugging and error handling statements provided by MBASIC. All in all, MBASIC appears to be an excellent language for business and scientific applications, although unfortunately it lacks matrix manipulation statements. MAT statements, provided in some versions of Basic, considerably simplify the task of writing scientific application programs, but are unlikely to be missed in business applications.

Also included with the Otrona is WordStar Plus 1.0 (by MicroPro International). This CP/M word processing system is considered by many to be the most powerful word processor in wide use, and particular enhancements to the Otrona version add even more appeal.

Otrona 512: vital particulars

Processor:	4 MHz Z80A
RAM:	64K
ROM:	4K containing Monitor and diagnostic programs.
Interfaces:	Two RS232C serial ports, 75 to 19,200 bps.
Keyboard:	IBM Selectric lay-out with programmable keys.
Display:	80 x 24 lines, 40 x 24 lines, 320 x 240 dot graphics.
Peripherals:	Two disk drives built-in, 360K per disk STD expansion board available.

Otrona 512: a remarkable portable

Most word processing functions are accessed by single keys on the top row of the keyboard, including insertion and text formatting. Cursor movement and a delete key are also labelled on the keyboard. The more conventional keyboard commands for standard WordStar, a combination of Control and alphabetic keys are also available.

As an indication of the features of WordStar, the instruction manual lists 124 commands and options, divided into groups including file management, cursor controls, text formatting, and basic and advanced editing commands. Such complexity can be overwhelming at first, but the manual written for the Otrona is clear and carefully graduated for the beginner, introducing the most frequently used commands first, and leading, with practice exercises, to full use of the system.

The inclusion of WordStar Plus is an attractive feature of the Otrona 512. For long sessions, however, concentration on the tiny video display quickly becomes tiring. A larger CRT monitor would be a necessity for lengthy use in such applications. On the plus side, WordStar for the Otrona makes good use of the highlight and half-intensity features of the video display.

Also supplied with the Otrona is "Charton", a program which allows the user to plot graphs, specifying headings and labels and the number of horizontal subdivisions to be shown. Vertical scaling is automatic, and a choice of bar graphs, line graphs and pie-charts is offered.

Graphs can be superimposed, and displayed with a range of shadings using the Otrona's definable graphics characters to fill blocks. Once displayed on the screen the graph can be printed on an appropriate graphics printer if hard copy is required, or updated to reflect new conditions.

"Valet", supplied with the standard machine, can be accessed at any time from CP/M. This program works in conjunction with the battery-powered clock/calendar to allow the user to set up to six appointment reminders or other alarms. Each alarm consists of a time, date and message. When the Otrona is running the alarm will interrupt the current program at the specified time, automatically saving work in progress, and display the preset alarm or reminder message.

A 14-digit, four function Reverse Polish Notation calculator is also incorporated into Valet for mathematical operations. Valet also contains the printer driver routines for graphics screen dumps, and the setting procedure which allows the user to adjust the brightness of the display screen, volume of the keyboard sound, bell on/off and the baud rates of the communications and printer ports.

To round off this array of software a communications package and an electronic spreadsheet calculator will also be available. Needless to say, any other CP/M compatible software will also be run on the Otrona 512, providing it is available correctly formatted for the Otrona's double density 14cm disks.

Manuals supplied with the Otrona include specially written versions of the WordStar-Plus and Basic-80 manuals and a copy of "The CP/M Handbook" by Rodney Zaks. We were also provided with a preliminary programmers' guide.

Who will it appeal to?

Apart from well-heeled free-lance journalists, the Otrona 512 portable would be an attractive proposition for the businessman on the move, executives who want one personal computer for both the home and office and those involved in extensive field-work. The main attraction is the saving in time and money made possible by the computer.

A demonstration cost analysis program used by Otrona dealers, in fact, calculates the "pay back" period of the machine, based on estimates of the time saved in document creation and filing, analysis and business planning and communications. Otrona claim that the computer will pay for itself in under 12 months in common middle-management applications.

Applications which can only be filled by a portable computer include the collections and analysis of data in the field (whether "the field" is a scientific research station or a salesman's territory) and the creation and display of transportable management and marketing presentations. The traveller who brings his own computer to back up his arguments with facts, figures and graphics displays cannot help but make an impression!

At $4995 for the basic unit, the Otrona 512 is not cheap. This price, however, includes all the software required for a fully functioning business system, disk drives and communications ports. There is nothing else to buy unless hard copy is required, in which case any one of a range of serial printers can be added.

The computer is compact and sufficiently robust to bear the rigours of travel, whether under the seat of a passenger plane or in the boot of a car. As a ready-to-go, hard-working portable computer the Otrona is an attractive proposition. You can even use the computer to work out if the expense was worthwhile!

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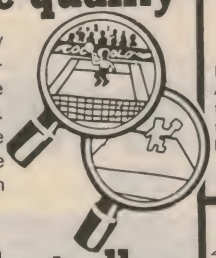

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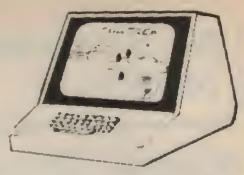


Atari looks for new games to play

"To dream and to take risks" is how Dr Alan Kay describes his job as chief scientist at Atari, the video games and personal computer subsidiary of Warner Communications. In the face of falling profits it will be his dreams that form the basis of Atari's future products — a new world of video games.

Atari was acquired by Warner Communications in 1976. At that time it had a turnover of $US28 million, after being started in the garage of a young engineer in 1972. By 1980 turnover had jumped to $US400 million, and last year sales topped $US2 billion. Atari now accounts for 55% of Warner Communications total business and 70% of the group's total profits, although profits were down in the last quarter of 1982.

Today Atari is divided into three operating divisions; coin operated games, consumer electronics and home computers, and wields a research budget bigger than that of some government groups. The company expects the home video games market to reach saturation point sometime in 1985, with games installed in 60% of US households, and has gathered together some of the most creative minds in computing to chart new directions for growth.

According to Dr Kay, "Humans are communications junkies. They are fascinated by anything that improves their ability to communicate and are not too worried by the cost." The second theme is the basis of the appeal of all video games, what Kay describes as the "human desire for a simpler, safer more controllable but more exciting world".

Of video games Dr Kay says: "Games, sports, theatrics, music and science – all provide more than escape. They are crucibles for creativity and learning. This is why video games and computers are not just a passing fad but instead appeal to deep human needs."

More than one commentator has pointed out that today's successful video games are based around one or other of the "seven deadly sins". When the games first appeared the appeal was the violent destruction of invaders. Today the appeal seems to be to greed, with games such as "Pacman" based on a tiny animated character that gobbles up everything in sight.

"Pacman" (a trademark of Atari), has "gobbled up" over $US1 billion – more than the total receipts of the three top motion pictures in history.

Dr Kay has always been concerned with removing the barriers between people and computers. Before joining Atari he was chief scientist at the Xerox Palo Alto Research Centre, where he designed "Smalltalk", a high level language which treats programs in the computer as objects which can be directly manipulated by the user to form new constructs, even new programming languages.

If Dr Kay's ideas bear fruit the games of tomorrow will require far more interaction between human and machine. Some of the Atari group's long-term research plans are aimed at creating better graphics and games which allow the user to invent stories and participate in the action. The hardware is already available or on the drawing boards, but software is the limiting factor.

The next big step may be artificial intelligence – programs that respond and make decisions based on problems posed by human players. Beyond that Dr Kay is reluctant to make predictions. "Everyone failed to predict the big moneymakers of the 20th century such as the telephone and television. Most people don't know they want something new until they try it" Kay says. "The best way to predict the future is to invent it."

National Semiconductor introduces 16-bit micro

National Semiconductor Corporation has released an evaluation board for its NS16032 16-bit microprocessor. Each kit includes a CPU, the NS16201 timing control unit and data sheets. Two versions are available, one for 6MHz operation and the other with a 4MHz CPU.

Also new from National Semiconductor is a 4MHz version of its NSC800 CMOS microprocessor. Features of the device include single 5V operation at 21mA and compatibility with the Z80 instruction set.

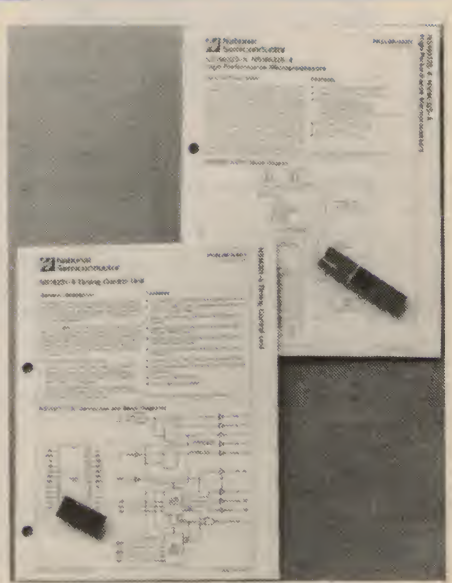
The chip uses a multiplexed bus structure and provides an on-chip bus controller, clock generator and dynamic RAM refresh capability. Five interrupt request lines are also provided.

Externally the chip is compatible with the Intel 8085 microprocessor, which is often used in controller applications.

National see the NSC800 being used in applications requiring high speed and low power consumption, including hand-held terminals, personal computers and robotics.

On a more mundane level, National Semiconductor has announced a new integrated circuit, the MM5437, which can be used as a digital noise source generator or a pseudo-random number generator. The chip has been designed to produce a broadband white noise signal with uniform noise quality and output amplitude and is intended for use in percussion synthesisers, white and pink noise generators and room acoustics testing and equalisation.

For more information on these new products contact National Semiconductor, Cnr Stud Rd and Mountain Highway, Bayswater, Vic. 3153.



National Semiconductor's NS1600 series chips.

Microcomputer News

Standard Microsystems floppy disk controller

Standard Microsystems has just released a new S-100 floppy disk controller board, the FDCS100, able to handle up to four 20cm or 14cm single or double-density, single or double-sided floppy disk drives with any standard S-100 bus computer.

Data separation is performed by a digital phase-locked loop which is said to require no analog adjustment. A 2K EPROM on the board can contain up to four 512 byte bootstrap routines, selected by a switch according to which disk format is in use. A software controlled serial port is also provided on-board for connection of a terminal.

The board can be configured for either polled or interrupt-driven operation, and many be used in either both memory-mapped and I/O mapped systems.

Standard Microsystems' boards are distributed in Australia by Total Electronics, 9 Harker St, Burwood, Vic 3125. Phone (03) 288 4044.

TRS-80 program speeds up cassette operation

"Hisped", distributed by CISA Microcomputer Pty Ltd, is an enhanced cassette operating system for the TRS-80 Model I computer.

Hisped speeds up tape operation when saving and reading large data files by using only one tape leader and saving all array data in a continuous stream. Both data and programs can be handled, with error checking at the end of each 255 byte block. A "Verify" command is also provided which checks the data on tape against data in memory on a byte-by-byte basis.

In addition to high speed tape routines the program includes a printer driver and print formatting routines which allow other machine language programs to be combined without the problems posed by conflicting printer drivers. Seven cassette speed operations are provided from 500 baud to 2000 baud. The three higher speeds are not compatible with the Tandy XRX tape loading modification, and all operations depend on the quality of the cassette recorder.

Hisped is easy to load and use and provides a significant enhancement of the TRS-80 tape and printer routines. It is available from CISA Microcomputing, 159 Kent St, Sydney, NSW 2000, or phone (02) 241 1813.

Sanyo MBC 1000 offers "System Solutions"

Sanyo's new MBC 1000 microcomputer is supplied as a self-contained package including a 4MHz Z80 CPU, a 30cm green phosphor monitor and a detachable keyboard with separate numeric keypad, cursor control keys and five programmable function keys. Included in the price is a single 14cm disk drive with a 428k byte capacity (unformatted) and one Centronics parallel and one serial port.

Additional disk capacity can be added in the form of three additional 14cm disk drives or two 20cm drives, and two additional RS232C ports are available as an option.

An additional terminal can be added to the basic system with one disk drive, allowing a limited set of program facilities such as stock enquiries to be accessed while the main computer continues to run a full set of programs. By adding a second floppy disk drive or a hard disk up to three remote terminals can be supported, each able to perform the same functions as the master console.

Multi-tasking is also offered, providing advantages even to users of a single Sanyo system. With multi-tasking, printing of one set of data can be carried out at the same time as another program is running. Up to seven tasks can be handled concurrently in this fashion without appreciable lag in reponse time.

The MBC 1000 comes with the CP/M operating system, but Sanyo is also offering an advanced range of software known as "Sanyo System Solutions". Packages in the range so far include a debtors ledger, stock module, purchase orders and creditors modules, a general ledger and payroll accounting as well as a simplified word processor for the production of form letters. All of the modules can be integrated for data transfer and accounting updates.

Also available from Sanyo is the CRX 1000 computer terminal, providing an 80 column by 24 line green phosphor display, typewriter style keyboard, separate number pad and RS232C and 20mA interfaces with switch-selectable baud rates from 75 to 19200bps. A second RS232 interface is provided for attachment of a printer and a Centronics port is optionally available.

Dimensions of the terminal are 410 x 580 x 320mm (W x D x H).

Further information is available from Sanyo Office machines Pty Ltd, 127 Walker St, North Sydney 2060.

Parallel-to-serial converters from Alfatron

Victorian company Alfatron Pty Ltd has released a line of Centronics-parallel to RS232C serial converters. The AL range is designed to convert a serial input into a parallel output, and is available with either a 256, 1024 or 2048 byte buffer built-in.

Baud rate is switch selectable from 110 to 9600 bps, and handshaking is in the XON/XOFF format. The units are designed to draw power from the Centronics device if possible, but power may be provided from an optional plugpack. Power consumption is 400mA at 5V.

The units come fitted with a "Velcro" strip to allow mounting either inside or outside of existing equipment. All switches are inside the case to prevent inadvertent alteration.

Also from Alfatron is the CS-256 parallel input to serial output converter, said to be especially useful when a printer must be installed at a distance from a system equipped only with a parallel port.

An added feature is that all units can be optionally programmed to allow conversion between different communications protocol.

For further information contact Alfatron Pty Ltd, 1761 Ferntree Gully Road, Ferntree Gully, Vic. 3156. Phone (03) 758 9551.

Microcomputer News

Multi-user computer has five microprocessors

A new release from the US company Integrated Business Computers is an indication of what the future holds.

The "Ensign" computer system, according to IBC president Randy Rogers, "has been designed to be the fastest, most powerful multi-user microcomputer system in the world". Five microprocessors are used in the computer.

The main CPU is a Motorola 68000 running at 8MHz. Two Motorola 6801 processors handle all serial I/O for up to 32 attached terminals, and a 6MHz Z80B is used to supervise all disk and tape input and output with another Z80B used for memory management. Relieved of overhead for communications, tape and disk operations and memory management, the 68000 is able to bring its full power to bear on computing problems.

Eight megabytes of main memory can be included in the Ensign, with up to 512K bytes allocated to each user. In addition over 1000 megabytes of mass storage can be added, using hard disks or cartridge and nine track reel-to-reel tape. Both OASIS-16 (tm) and Unix (tm) operating systems can be supported.

The Ensign is available from Integrated Business Computers, 21592 Marilla St, Chatsworth, CA 90311.

AID keyboards from Daneva Australia

Daneva Australia Pty Ltd now has available a new alphanumeric keyboard from Advanced Input Devices, the MK059-001.

Features of the keyboard include low profile (12.5mm), 18mm key spacing and fully sealed switch construction. Overall dimensions are 114 x 273mm, and the switch matrix outputs are said to be compatible with the RCA CDP 1871 CMOS keyboard encoder.

For more information contact Daneva Australia Pty Ltd, PO Box 114, Sandringham, Vic. 3191. Phone (03) 598 5622.

Computers at work: automated testing

Elmeasco Instruments is now providing what they believe is the only automated PCB testing and programming facility of its kind in Australia. Using the well-known Fluke 3000 Series Automated Board Tester, both digital and analog boards can be handled.

Most testers require painstaking development of test words bit-by-bit. In contrast, the Fluke 3000 Series simplifies programming by providing a large array of signals with various duty cycles and relative frequencies which will exercise all but the most complex circuits.

Up to 232 digital I/O pins and up to eight analog pins can be handled with automatic fault emulation providing close to 100% fault coverage.

While many potential users are put off by the seeming complexity of automated board testing, Bert Kleverlaan, Elmeasco's Marketing Manager, says that automated testing is often viable even when only a very few boards need testing.

"Naturally most people think of automation where large quantities are involved. But it is equally important to think of the complexity of the task. We have had situations where the man-hours involved in individual board tests have almost equalled programming time. Once the program is developed, the test may take only a matter of minutes by machine. Without automation the customer will expend the same man-hours every time he needs to check a board.

Further information is available from Bert Kleverlaan at Elmeasco Instruments Pty Ltd, 15 McDonald Street, Mortlake, NSW, or telephone (02) 736 2888.

Also from Elmeasco is a new short-form catalog of Datel-Intersil products. The free catalog includes product listings and information on hybrid and monolithic modules such as A/D and D/A converters, sample-and-hold circuits, multiplexers and analog I/O boards, digital panel meters and power supplies.

Enhanced Monitor for the Exidy Sorcerer

An enhanced version of the monitor program for the Exidy Sorcerer computer is now available from Daniel Wong. Called DWMON 2.1, the new monitor is compatible with the Exidy V1.0 version but includes many new features.

The new monitor includes a video terminal mode which allows the Sorcerer to become a stand-alone terminal using the built-in RS-232C port, and a routine to automatically boot up a disk operating system on switch-on or reset.

The Exidy CREAT, OVER, LIST and BATCH commands have been eliminated to make room for the new features. The existing ENTER command now displays the current memory contents in ASCII as well as hexadecimal, as does the memory DUMP command. The MOVE command has been altered to allow memory contents to be moved up or down between blocks of memory even if they overlap, and new FILL and COMPARE commands have been added.

Blocks of memory can be filled with any character, and the contents of two data blocks compared. A SEARCH command allows any string of hexadecimal or ASCII characters to be found in memory. The monitor will also accept lowercase commands, and an optional beeper is available which will respond to the ASCII BEL character (07H).

The existing pre-defined graphics characters of the Sorcerer have been removed from the monitor EPROMs and are now stored in the previously empty space of the EPROMs in Exidy's Basic ROM Pak. Apart from allowing more space for the monitor enhancements this means that subsequent clearing of the screen will not re-write the standard graphics characters into the programmable character RAM spaces – a benefit that will be appreciated by many Sorcerer users.

The complete enhancement set consists of three EPROMs, two to replace the existing monitor and one for use in the Basic ROM Pak. The third EPROM can be dispensed with if the pre-defined graphics are not required by the user.

The complete kit of three EPROMs costs $40. If the Basic graphics ROM is not required the price of the monitor is $32, with the optional solid-state beeper circuitry available for $30.

For further information contact Daniel Wong, PO Box 32, Westmead, NSW 2145.

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DICK SMITH INTRODUCES

the first direct modem to meet new Telecom regulations & at an incredibly low price!

The data communications revolution has now reached Australia. More and more personal computer users are communicating with other computers via the telephone network, to exchange data and programs with other personal computer users and to access the growing amount of valuable information in the big computer "data bases".
Until now, the only type of telephone modem available for use with personal computers has been the acoustic coupled type. These are expensive, and also depend heavily on the telephone's old-fashioned carbon microphone. As a result, even the best units of this type are often not capable of really reliable, trouble-free operation. But now, after months of development work and negotiation with Telecom Australia, Dick Smith Electronics presents the Dataphone — a telephone modem that really is suitable for personal computers. It's not an acoustic-coupled type, but a true high performance, direct connect model. And it's authorised by Telecom. Even more importantly, it will cost you less than half the price of a comparable acoustic modem!

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Cat. X-3272

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Microcomputer News

Facit daisywheel printers from EAI

Facit has announced the release of a compact daisywheel printer, the Facit 4565. The new "letter quality" printer will produce both fixed and proportionally spaced text at up to 40 characters per second and is said to be compatible with machines such as the Qume and Diablo daisywheels.

Features include a choice of printing modes, with either character by character or line by line bidirectional printing or direct addressing of the printwheel and carriage by the host computer. Attributes such as underlining bold text and graphics are also available.

Facit printers are distributed in Australia by EAI-Electronic Associates Pty Ltd, PO Box 170, Crows Nest, NSW 2065. Phone (02) 439 7522 or, in Melbourne (03) 699 7100.

News from the clubs

● The University Computer Club of the University of Western Australia has been established since 1974. The club has its own Alpha 16 microcomputer, with extensive software developed by club members. A recent new purchase is a 16-bit computer board using the National Semiconductor 16032 CPU. Contact the club on (09) 386 1455.

● A Microbee users' group has been formed in Darwin under the name DBUG. The club can be contacted by writing to GPO Box 3111, Darwin, NT 5794, or phoning Felino Molina on 88 1455 (AH).

● The Zebra-Xray 80 newsletter and the Australasian ZX Users Newsletter have merged forces under the second name. Price of a year's subscription is $15, with single issues at $2 each. For further information contact the Australasian ZX Users Newsletter, PO Box 397, Dapto, NSW 2530.

● The Melbourne Super-80 Users Group has sent us a copy of their monthly newsletter, containing a "lunar shuttle" game and details of Super-80 keyboard routines as well as comments on new peripheral devices. The group has an extensive membership and meets on the second Friday of the month at the Heathmont Uniting Church, Canterbury Road, Melbourne, at 8pm. Annual subscription to the newsletter is $12.

For more information contact Victor Shuttleworth, 17 Stephen Crescent, Croydon, Vic 3136.

50 & 25 YEARS AGO

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

February 1933

Repeat Programs: Dear Sir, — May I crave a small space to protest most strongly against the Commission's practice of repeat programs. It is bad enough to have gone to the expense of a 5-valve set and get national relays, not forgetting the 24/- per year for the privilege of hearing these repeats. I find it is only necessary to buy one "Wireless Weekly" per fortnight, as one week's program on national stations serves its purpose the following!

Yours, etc,
A. WESTON

Ca· ,psie (2/2/'33).

☆ ☆ ☆

Thought Waves: At the meeting of Harringtons' Radio Club on January 27 some unique experiments were carried out. The occasion was a lecture and demonstration on the transmission of "Thought Waves". The lecture, delivered by the president of the club, based on notes from Mr A. Bird, G6AQ, London, dealt with the phenomenon referred to as the "aura" which it is asserted all human beings possess.

☆ ☆ ☆

Luck Charms: Back in the old days the ancients said that those who had faith were truly blessed and received what they believed in. They themselves had faith in all sorts of things — charms to bring luck, charms to bring health, charms to bring happiness, charms to bring wealth. They combined all four in the Swastika — and right through the years, the Swastika has been accepted as a luck token of extraordinary power. It brings to those who wear it and believe in it good luck. Here's an opportunity for readers to get a lucky "Health, Wealth and Happiness" Swastika in gleaming gold.

(From an advertisement)

February 1958

Stereo Discs: Stereophonic disc recording is a prospect for the immediate future. Not so long ago, during the Audio Engineering Society's convention in New York City, two systems of stereophonic disc recording — both using a single groove and single stylus — were demonstrated. Comments of manufacturers and engineers left little doubt that commercially practical disk stereo has arrived, and it is confidently expected that major record manufacturers on both sides of the Atlantic will start producing stereo discs this year.

☆ ☆ ☆

Lab Suits: According to a recent report in "Electronics" (Business Edition), space suits are being used to allow engineers to work inside a vacuum chamber pumped down to a sufficient order to allow valves to operate normally without envelopes. This is happening in the Lab at Litton Industries. Electrodes of the valve can be moved while the tube is in operation to find optimum positions for the desired results. Chief use to date is for work on the Chromatron colour TV tube.

☆ ☆ ☆

Red Hot Valves: The penetration of the "thermal barrier" in the production and use of electronic tubes appears to be in sight. An American company recently announced the development of valves, resistors, capacitors, transformers, printed circuit boards and other devices capable of operating at temperatures up to 1500 degrees Fahrenheit.

The new devices are made of ceramics and metal such as titanium that have high melting points. With the apparatus operating at such high temperatures, one series of valves does not need a power supply to heat its filaments.

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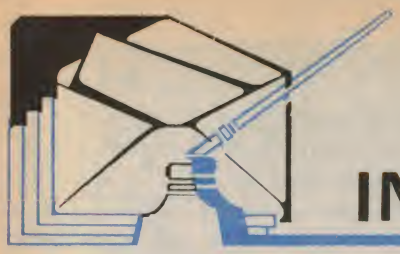
T182/A



INFORMATION CENTRE

CASSETTE RECORDER: Recently I was listening to a friend's portable stereo cassette recorder. I think it was a Philip's, for which she paid about $100. The unit has a three position switch: mono-stereo-spatial. The effect produced by the spatial is like listening to (hard to explain) greater music, fuller, like in a concert hall. By the way it's not "loudness". Somebody said it is a type of echo effect.

I was very impressed with the sound and the reason for writing to you is to find out if you have a similar project or if you would consider this one for a later project. I am sure a lot of hobbyists would appreciate it. (B. I., Launceston, Tas).

● Circuits to enhance stereo separation generally do so by subtracting some of the opposite channel signal from the main signal in each channel and thereby increase the difference between the two. This can be done fairly simply with a couple of op amps and a suitable crossfeed circuit.

A superior way of enhancing stereo is to use bucket brigade devices to increase the interaural delay, ie, the perceived time differences.

Our stereo synthesiser described in September of this year can also be used to enhance normal stereo reproduction. Apart from this we have not published any circuits along these lines. We will consider this for the future.

SUPER-80 KIT: I have recently constructed the Super-80 kit, and have come across a few unusual problems. The only problem encountered during construction was getting the LED and relay to pass the test. I got over this after numerous tests checking the waveforms and pulses in the LATCH circuitry but to no avail. Finally, as a last resort, I inserted the remaining chips. It worked when I put the power back on. From then on the computer looked as if there were no other problems.

I ran some short programs and they worked perfectly. However, when I tried loading programs that have been saved before, occasionally some letters or characters in the display change. Worse still, it lost the entire program after running it. Note, it only happens occasionally. It happens most frequently when, after a typing or programming session, I switch the set off and about 15 minutes later I load back the program. The listing initially looks alright, but a few seconds later, some characters change causing a previously working program to develop typing errors.

Another problem is that sometimes it doesn't change a line instruction even though I have already typed in a new one at the same line number. Once, it kept recognising line 70 instead of line 170, making editing impossible.

The computer sometimes gets locked in a state where only a hardware reset gets the flashing cursor back on the screen; the program in memory is lost of course. I am using Basic in EPROM.

Initially, I suspected the RAMS but after swapping them around, the problem persisted. There is no problem relating to the cassette interface, as it loads alright since the program listed after a load is correct, only that the bits in the program change sometimes. The bit changes are at particular lines only. Occasionally when I notice a bit change, I list the program and that particular bit reverts back to what it was. After some time it changes again.

I suspect that the refreshing circuitry is not working properly. Please advise and if possible pinpoint the fault. Also, could you please tell me which RAM chip is the first 2K? (S. L., Mulgrave, Vic).

● We will answer your last point first in order to clear up a misconception. No one RAM chip is the "first 2K". Dynamic RAM chips are organised as 16K x 1 bit, which means that the first chip holds all the least significant bits for the whole 16K.

The second chip holds all of the next least significant bit for the entire 16K of data, and so on. Memory errors can be localised by observing which bit in each data byte is affected. In Row 0 (the first 16K bank of memory), U53 holds all the 0 bits, U56 all the 1 bits and U59 all the bit 2's.

Memory errors are generally caused by power supply fluctuations. There are two sources of the problem. When dynamic memory devices are written to they draw a large supply current momentarily, which must be supplied by the reservoir capacitors adjacent to the memory chips. This problem was solved in the prototype by installing additional capacitors on the memory chip power supply lines, as close to the affected chip as possible.

Pay particular attention to the −5V supply rail, including the bypass capacitors on each side of the −5V regulator, which may need to be increased in value.

A second source of memory errors can be power line interference, particularly if the errors seem to be associated with switching another device on or off. Many Super-80 owners have fitted their computers with a mains-interference filter, which appears to help solve problems of this type.

A technical bulletin, No. 53, from Dick Smith Electronics describes another problem: the appearance of rows of "@" symbols on the video display. The problem is caused by the arbitrary interruption of memory access cycles at the transition of the BUSAK signal which initiates the scanning of video memory.

The technical bulletin describes the installation of an extra flipflop to synchronise the leading edge of the BUSAK signal with the MREQ2 signal derived from the video circuitry. The technical bulletin is available on request from Dick Smith Electronics.

FLUORESCENT STARTER: Instead of building your electronic starter for fluorescent lamps (EA, October 1982) I tried a 1μF capacitor and found that it seemed to give the same results as your circuit I wondered what you thought. (J.C., Bombala, NSW).

● Many fluorescent tubes will start without starters, particularly 20W types. Since your connection energises the heaters, it is not suprising that it works. However, it is highly unlikely that it would work in most cases.

240V INVERTER: After building the 12-230V inverter in the June 1982 issue, I found another error which was not noted in the following months. The mains colour coding showed the two white wires being 230V which was found to be incorrect. After connecting the wiring as shown on the diagrams the following components were destroyed: TIP3055, 390Ω resistor, 6.8μF capacitor, red LED and LM324. I am just wondering if anybody else has had this problem with their inverter as this is a very expensive project. I think all problems of this nature should be found before these projects are published. I am enclosing the repair bill for the inverter which I had

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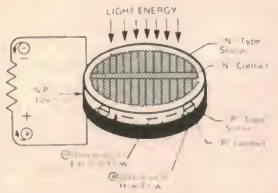

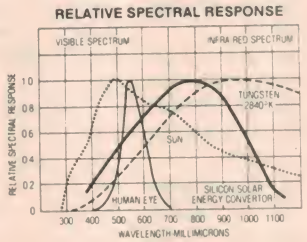

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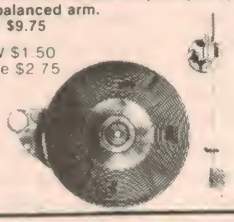

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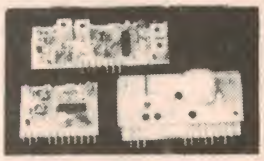

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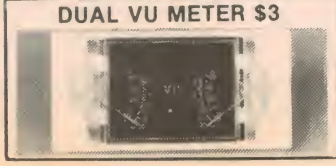

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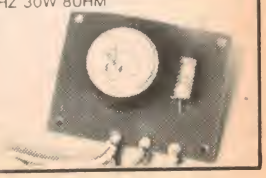

to pay because of your magazine's faulty wiring diagram (B. T., Wangaratta, Vic.)

● Before publishing the circuit of this inverter, we contacted the manufacturers of the transformer concerned to confirm that the white wires were, in fact, to be only used as the 230V windings. The blue wires are used for the low voltage 12V winding. This was verified and we feel justified in having indicated that the white wires are the 230V winding. We regret that you have experienced this problem but it appears that you have been supplied with a transformer with incorrectly coded leads. We have not had any other complaints along these lines.

DIGITAL READOUT: I read the article "Digital Readout for Shortwave Receivers" (EA Oct '82) with great interest. However there must be many people who own an FRG7 receiver for which the above is not suitable, as mentioned in the article, but would like digital readouts.

Most circuits I have seen only show the decimal parts of the MHz but I have thought of a way that would show the MHz reading also. The basic design is that shown in "Radio Tuner Frequency Counter" by J.L. Linsley-Hood in *Wireless World,* October 1980 – which by the way is very similar in concept to your own design.

As you know the first VFO in the FRG7 tunes55.5MHz to 84.5MHz in1MHz steps. If this signal was amplified by a FET and passed through a divide-by-100 stage and then a further divide-by-100 stage the signal would be 5550 to 8450 cycles in 100-cycle steps.

This is then fed into two stages of a 74C192 counter set in the count-up mode and preloaded with 4 & 5; the readings would then move from 00 through 29 which is required (the 1 overflowing).

For myself and other owners of an FRG7 I hope the above is "food for thought" and that you may publish, in the not too distant future, a design for the FRG7. (E.P., Black Rock, Vic.)

● Your letter certainly is food for thought. Another of our readers has drawn our attention to a "Circuit & Design Idea" item published in our April 1970 issue. This suggests a way of interfacing Wadley loop receivers, such as our Deltahet, by using a mixer for the tuner VFO and a suitable crystal oscillator. This enables the actual tuned frequency to be accurately determined.

TRANSFORMER 1: I was recently reading one of your magazines, a fairly old one, belonging to one of the teachers at our school. In it I particularly noticed an article on a car called Transformer 1, (Pages 28-29, April 1977) and, being interested in electric cars, I wondered if there is anywhere that I could get further information on the car. (A.M., Goodiwindi, Qld.)

● We have no further information on this car but it is briefly described in "The Complete Book of Electric Vehicles" which is currently available from Dick Smith Electronics stores.

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The Serviceman

cont'd from p76

supposed to. Looking at the circuit again I could see only one other possibility; a line from the collector via a 1Ω resistor (R459) to a plug marked "DD" and pointing to another plug marked "LC".

Plug "LC" turned out to be on the chroma/decoder board and, more specifically, the line I was tracing went to the base of transistor Q204, the vertical retrace blanking stage. This is driven from the collector of the vertical switch (BC327), via the line I had just traced, and is wired as an emitter follower. Output from its emitter is coupled to the base of the third video amplifier, so as to cut it off during the retrace period.

At least, that was what was supposed to happen. I suddenly realised that I had chosen to ignore what could have been a vital clue. When the picture was in its collapsed condition it was somewhat brighter than normal and was also showing some evidence of retrace lines; something which I had tended to brush aside as a by-product of the reduced scan.

It took only a few moments to check the voltages along this run, from the collector of the BC327 up to the base of Q204. From about 10V at the collector it rose by about 0.5V on the other side of R459 and this same voltage appeared at the base of Q204 which, according to the circuit, should have had only 0.15V on it.

This transistor, with 20V on its collector, was now the prime suspect. I reached for the soldering iron, pulled the transistor out and, without waiting to test it, switched the set on again. And that was it. The picture came up to full scan, overscan in fact, and once I readjusted the height, was virtually perfect except for retrace lines.

I fitted a new transistor, a 2SC711 (no shortage of these), and that effectively wiped the retrace lines. Then I hooked up the old transistor to the tester and found, as I fully expected, that it was very, very leaky. The only other point being that, whatever the nature of the transistor fault, it was not consistent.

And so the set was duly returned to the customer, who was quite happy with the result – or as happy as anyone is when they have to pay out for a service job. The truth is that this set had suffered two transistor failures in 12 months; so much for the reliability of solid state devices, something about which I, and a lot of my colleagues, are becoming extremely sceptical.

Notes & Errata

ULTRASONIC RULE (August 1982, File 3/MS/94): The PCB artwork on page 82 of the article has a track missing between the cathode of the 3.9V zener diode and the adjacent 33kΩ resistor. This is correctly shown on the overlay diagram on page 79.

FLUORESCENT STARTER (October 1982, File 2/PC/33: The errata on page 133 of the January issue suggests reducing the .015μF capacitor to 0.1μF if tubes prove difficult to start. This should have read .01μF.

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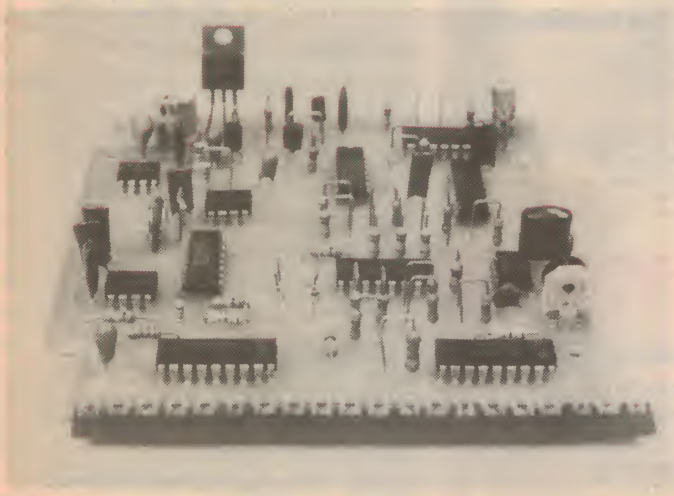

* Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the articles mentioned here.

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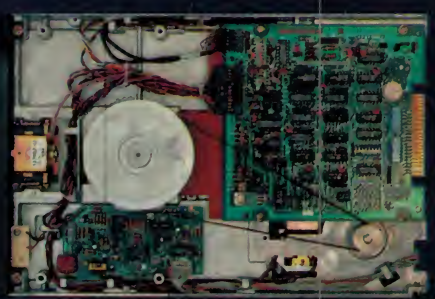

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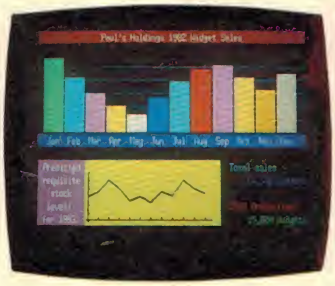

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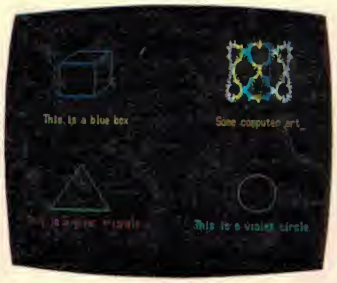

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